PC
MAGAZINE

**Free Utility: Enhancing
the Enhanced Keyboard with
Shift Keys That STAYDOWN**

20-MHz
Model 80:
IBM's Best

But Does the Top-of-the-Line
PS/2 Measure Up?

- Speed vs. Compatibility:
  PC Labs Tests 13 9,600-bps Modems

- Project Database:
  9 Easy Relational Databases

- First Looks Preview:
  Ashton-Tate's dBASE IV

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SIDEKICK *Plus:*
Working at the speed of thought

It's an idea whose time has come. It's accomplished with a remarkable new tool that lets your personal computer follow your ideas wherever they lead. That gives you access to some of the most powerful productivity tools on the market today. Instantly. And effortlessly.

Sure your co
lots of things, b

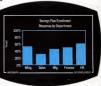If you're like most people in business, a day doesn't go by when you don't have many balls up in the air at once.

But your PC is probably not equipped to help you with all the different aspects of your job. And if you're using the computer for more than one task, it's often annoying and time consuming jumping back and forth from one program to another.

Lotus® Symphony® is designed for busy PC users like you who need to do many different jobs on the PC.

In one package Lotus Symphony

Graphics. Instantly turn your spreadsheet data into a graph. Choose from six graph types.

Word processing. Write a document in the full-featured word processor. Even include a spreadsheet.

Spreadsheet. Create a table in a spreadsheet that will automatically calculate formulas, allowing for what-if analyses.

combines spreadsheet, word processing, graphics, database and communications, putting five key business tools at your finger tips. And you only have to learn

one program to work with all five applications.

Unlike many integrated software packages, the depth of each individual Symphony application is not sacrificed for the sake of integration.

Each of the functions is powerful enough to meet your growing computing needs. In fact, the spreadsheet, with an extensive command language, is based on the very same technology as 1-2-3® the industry standard.

mputer can do
ut can it juggle?

And since Symphony is from Lotus, it's compatible with a variety of other Lotus products which means Symphony

Database. *Store information in a powerful database that can hold over 8,000 records, each with up to 256 fields.*

users can share files with 1-2-3 users, for example.

What's more, the all-in-one nature of Symphony makes it ideal for use with laptop computers, so you can take your whole office with you.

The newest version of Symphony, Release

2.0, has no copy protection and comes with many new features, including enhanced database and word processing, a spelling checker and text outliner, plus minimal recalc for faster spreadsheet performance, DCA file translation to exchange data with other programs, as well as VT100 terminal emulation.

Communications. *Send or receive data between your PC and a mainframe, another PC or as on line information service.*

Symphony is used by hundreds of thousands of satisfied PC users.

And because it's from Lotus, the leading developer of PC applications software, you can be sure we'll continue to enhance and support the product as your needs and technology continue to evolve.

So, if you'd like your PC to help you keep up with the varied functions your job entails, have Symphony teach it some new tricks.

Lotus Symphony 2.0

WHAT'S INSIDE

Reviewer Mike Falkner first put his skills to work for *PC Magazine* with his contributions to the accounting blockbuster we brought you in September. Since then, he's established a reputation around here for his insightful reviews, his good humor, and his capacity for hard work. He needed all three for his review of *Nutshell Plus*, which appears in this issue in Part 2 of our Project Database series.

It's not that *Nut-shell Plus* was tough to crack. PC Labs database benchmark tests were designed to push packages to their limits—and Mike, a taskmaster, took them even further. None of the databases reviewed ran tests on our 32,000-record test file within the 3 hours allotted in the test guidelines.

But Mike, ever curious, didn't give up when time ran out. He sat up with his PC—stopwatch in hand, eyes glued to the screen. Hours passed. The clock was still running. Mike went out for fast food, but—determined to measure the import time—he hung his stopwatch in front of the screen, pointed a video camcorder at the monitor, and zoomed in to record the time and screen changes.

Mike captured the moment on film. His production won't threaten the ratings of "Masterpiece Theatre," but it stands as a great performance at *PC Magazine*.

Also in this issue is contributing editor Winn L. Rosch's review of two 20-MHz PS/2 Model 80-111.

The first 20-MHz PS/2, it arrived for testing in PC Labs a full 3 months after the Compaq Deskpro 386/20. All of us were

Persistence pays: reviewer Mike Falkner put his camcorder to work with his PC and stopwatch to benchmark-test a database.

eager to see if the long-awaited machine could match the raw speed of the Compaq—no one more so than Winn, who in an earlier review of the 16-MHz Model 80 declared it the "best-built personal computer ever."

"Times have changed since then. IBM is making even faster machines but so is its competition," said Rosch. "What's most important about the 20-MHz machine is the new direction it shows for IBM."

Users who are taking their personal computer systems in a new direction by installing the IBM version of OS/2 Standard Edition 1.0 will be interested in this issue's Lab Notes, in which Charles Petzold concludes two two-part series of step-by-step instructions for organizing the installation process.

And if aching fingers, small hands, or physical limitations are causing you grief whenever you try the Ctrl-F5 pivots on the now mandatory "Enhanced" keyboard, STAYDOWN, Jeff Prosise's latest utility and your fingers' best friend, can make those problems but a soon-forgotten memory.

Photograph: Rich Pedroncelli

The PostScript laser printer sure to get high ratings at its network debut.

The new 8-page/minute QMS-PS 800 II laser printer

The QMS-PS° 800 II is an 8-page-per-minute laser printer that combines the desktop publishing power of Adobe PostScript° with the superior printer technology of QMS, a leader in printer technology for 10 years. Exceptional paper handling, faster processing speed and a Canon° CX0° print engine with 10,000-page-per-month duty cycle give QMS-PS 800 II the versatility you need on your PC network.

A network sensation QMS-PS 800 II holds 500 pages, so operators aren't constantly refilling depleted paper trays. Users can even designate automatic switching between the two trays for doing letterhead/second page printing. Select faceup or facedown collation. And manually feed odd-sized paper stock.

With QMS ASAP™ (Advanced System Architecture for PostScript) proprietary technology, QMS-PS 800 II delivers outstanding performance. In fact, the more complex the page, the more it outperforms other PostScript printers. Two megabytes of memory, expandable to three megabytes, also add to the overall page processing speed when you are creating complex documents.

Type casting The QMS-PS 800 II comes with 35 resident typefaces (you can download more if you like). PostScript allows you to scale type to virtually any size, from minuscule to mammoth. PostScript also enables you to design, and redesign, your documents with exacting detail. You have total control over the final appearance of documents, with the ability to place text and graphics anywhere on the page. In short, you get the complete desktop publishing power that only PostScript can give you.

Critical acclaim The QMS-PS 800 II is certain to receive rave reviews on your network. And for a single-user set-up, there's the QMS-PS 810 laser printer. For a demonstration of either, call **1-800-523-2696** for the location of the Laser Connection dealer nearest you. And be sure to ask for *The Sourcebook™* – our exclusive catalog filled with the latest laser printer products and enhancements.

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CIRCLE 259 ON READER SERVICE CARD

PC MAGAZINE

FEATURES

The PS/2 Model 80-111's new memory card (right) holds 2MB dynamic RAM in 24 of IBM's own chips.

It looks good on paper.

You expect excellent letter-quality print from a 24-pin printer. And Citizen's new precision-built Tribute™ 124 delivers.

With razor-sharp letter definition at 66 cps. Attractive correspondence quality at 132 cps. As well as crisp, impressive draft printing at 200 cps.

You might be surprised, however, to find that the versatile Tribute 124 offers quite a bit more. Like a built-in push or pull tractor with top, rear or bottom feed. Automatic paper loading. Outstanding compatibility. Push-button convenience of a front control panel. Even optional color printing.

It also provides a wide selection of typestyles via available font cards. And produces striking high-resolution graphics.

With all these value-added features and an exceptional 12-month warranty, the Tribute 124 is very affordable. So, not only does it look good on paper, it looks good for less paper.

For the Citizen printer dealer nearest you, call 1-800-556-1234, Ext. 34. In California, call 1-800-441-2345, Ext. 34.

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CITIZEN™
Printers that run like clockwork.

Any cell can contain a complete other spreadsheet that you can access with a single key.

Plus, no matter where you are on a menu or what you are doing, just press function key F1, and you will get a help screen specific to that command or action. Or if you want to know about any subject you can pop up an index of over 400 topics and select the one you want.

Notepad Behind Every Cell

Another 3-D feature is that any cell can also contain a multiple page note that you instantly access with a single keystroke. You can write

FIG. 4. Now, instantly we are on level 3. Each level is a different spreadsheet. You could now move to the New York Times and see the detail on that figure. There is no limit to the levels you can go. Move right down to transaction level if you like.

notes, memos or letters that relate to your work, save them as individual files and even print them separately or with your spreadsheet.

Speed

Lucid 3-D is truly revolutionary. It is fast, fast fast! It is incredibly quick in performing calculations because it doesn't recalculate every cell every time you insert an entry. Instead, it only recalculates the specific cells that are affected by your change. This is called minimal recalc. Lucid also has a remarkable innovation called background recalc in which you are given control of the cursor the moment calculations affecting your viewing screen are completed. Other calculations you don't see continue on in the background during the next commands. The end result of this powerful combination is you rarely wait for a recalculation with Lucid. You find out what instantaneous is all about.

Lucid Learns

Lucid 3-D also lets you teach any combinations of keystrokes so that involved sequences can be done with single keys. Plus more than just remembering keystrokes. Lucid allows you to create Macros with loops, procedures and conditional branching amazingly all done automatically with simple menus. You can create your own menus that show the new features you have taught it. Another great feature is you can make your custom menus work like Lucid where one choice can take you down a level to a whole new set of choices. What's nice is that they will work from one spreadsheet to another.

FIG. 3 We want more detail, so let's go to Newspapers. Just press the Grey + Key.

FIG. 5. Of course, Lucid does multiple windows. Notice, you can simultaneously open windows in different directories, different drives, even down as many as 3-D levels as you like. No one else can do that.

Mouseability

Lucid 3-D was designed for both keyboard enthusiasts and mouse lovers alike. You can take your pick. Designed around the mouse from the ground up, the interface is smooth and natural. You select files to load from directory lists. Everything is point and click. What's more, any Lucid 3-D menu selection can be "moused" and the response time is "right now" instead of the sluggish "a little bit behind you" feel of add-on mouse menu systems like those you've seen with 1-2-3.

FIG. 6 We need those budget figures in the Word Perfect letter we are writing. Clipboard Dump does it right now.

FIG. 7 Here it is right in Word Perfect (or any word processor) just like you typed it. You can go the other way just as easily.

A window pops up with a library of function names you can page through with the mouse. Select, click and it's in the formula with no typing required. You even have a label window that you can fill (from the keyboard) with favorite labels and names so that you can insert them later with the mouse. There's even a pop-up calculator to insert numbers so you don't have to go to the keyboard very often.

It really permits that feeling of becoming one with your work. Lucid 3-D has windows of user defined range names as well as the macros named by the user that can be selected just by pointing and clicking. Icons that are easy to grab with the mouse let you resize and move the spreadsheet window with the ease you would expect. Plus you can go anywhere on the sheet by moving the mouse and clicking on the spreadsheet borders. And remember Lucid is designed so that any of those features are done with or without the mouse easily and quickly.

Audit

When you are staking a big decision on information gained from a spreadsheet you need to be certain that you have made no mistakes. Lucid offers five audit displays and printouts.

Masterwork

We could go on at great length about all the features and innovations in Lucid, but Lucid is more than a bag of features. What is most important is the pride and craftsmanship that went into its creation. It is a master-

Makers of **LIGHTNING™** disk speed up software, and **BREAKthru 286** Accelerator Board.

work. The overall feel is tight and polished. In fact, Paul Somerson, executive editor of PC Magazine, used one word to describe it... "Slick".

PCSG has built a reputation as a development laboratory producing products that you know are excellent. In 1983 PCSG dominated the Model 100 laptop market with ROM based software that every reviewer rated as excellent. In 1985 we produced **LIGHTNING** the pioneer and award winning Disk speed up software. In 1986 we developed the **BREAKthru 286** accelerator board that blew everything else out of the water, and later we topped ourselves with the Breakthru 12. Now in 1987 those who have worked with Lucid 3-D tell us "you have done it again. This is software everyone should have."

Even if you don't plan to abandon 1-2-3, Lucid makes sense. Files are converted between them with ease so there's not an interface compatibility problem. This means you can have the power and fun of Lucid 3-D without having to upset your present systems.

We are excited about Lucid 3-D. But don't take our word for it, take us up on our 60 day offer. Call us on our order line number and we will ship your order the very next day. The $149 offer will end as soon as our dealer network is fully stocked. But in the mean time we invite you to try Lucid as part of our "spread the news" campaign. Just pick up the phone and call us. We accept all major credit cards or you can order COD.

Exceptional spreadsheet for the IBM PC, PS and Compatibles.

LETTERS TO PC MAGAZINE

GETTING THE FAX STRAIGHT

We were disappointed to see our product, Smartfax, misrepresented in William Taylor's article "Just the Fax" (*PC Magazine*, January 26, 1988). Strongline, a company that had been considering distribution of Smartfax and submitted a beta copy of the board for review, was falsely listed as the manufacturer. Other errors in the story include:

- that Smartfax requests the time and date each time you asked it to transmit, when, in fact, it does this only when you enter the program.
- that Panasonic's Fax Partner is the only product that includes a built-in image editor when Smartfax has one.
- that the RAM requirement is 385K. It is actually 640K.
- that the list price is $995. It is actually $949.
- that there are 17 jumpers on the board when there were actually 16 and that the manual listed 21 jumpers when, in fact, the documentation did not mention the total number.

Oversights in the review, which according to Mr. Taylor's own evaluation are very important, include: Smartfax's unique file conversion, capable of preserving special print functions such as boldface, underline, double strike, superscript and subscript; and the choice of file conversion methods that Smartfax gives the user—one saves a converted file for use in the graphics editor and one lets the user convert and transmit the file in a single step.

Finally, the Smartfax product currently on the market includes many additional features not on the beta that was reviewed. Of these, the most significant is *PC Paintbrush* file conversion. Its absence on the beta was criticized by Mr. Taylor as a major shortcoming.

Y.T. Chen
Director of Marketing
American Data Technology
Pasadena, California

It's not our practice to review beta products. The distributor that sent us the board assured us it was a production unit and gave the reviewer the information on the pricing and RAM requirement. PC Magazine regrets errors in the review and will review the Smartfax board now on the market in a future issue.—Ed.

NOT SO WRY

It's bad enough that Robert Hummel made that offensive, sexist, and crazy remark "Gee, I wonder if they have a braille edition?" without John C. Dvorak including it in his column (Inside Track, *PC Maga-*

■ You would think that a magazine that deals with progress and state-of-the-art technology could get away from a prehistoric mentality.

zine, January 26, 1988). What's worse is that Dvorak insists upon calling the remark "wry" and says he was still chuckling over it "later that evening." *Wry* is not a word that any educated person would apply to that remark. You would think that a magazine that deals with progress and state-of-the-art technology could get away from this prehistoric mentality. Like some computer equipment, this "joke" was obsolete even before it made print. "Me man . . . you woman," he said, as he dragged her off to his IBM. *Grow up!*

Karen Strauss
New York, New York

CHECKMATE CHECKPOINT

I believe Donald Trivette blew it big-time in his review of *CheckMate* (After Hours, *PC Magazine*, January 12, 1988). Mr. Trivette notes that incorrect entries cannot be fixed with the reconcile function. He is right in this narrow view; however, he found it to be a real piece of cake.

All in all, I have found *CheckMate* to be a very useful utility. As I see it, its only drawback is that it doesn't have the capability to make me pay my bills before they are due.

D. Q. Williams, Jr.
Silver Spring, Maryland

Donald Trivette's article on *CheckMate* (After Hours) left the reader with a very negative view of the program. For example, the article placed a great deal of emphasis on *CheckMate*'s inability to place addresses on checks printed with the program, an omission of very little importance to me since most of the bills I pay come with preprinted envelopes. The review also completely ignored the pro-

■ **LETTERS**

gram's ease of use, reports, calculation menus, ability to store 50 predefined payees, and so on.

Although your magazine has a reputation for fair and accurate reporting, it really seems to be missing in this article.

Dan P. Fox
Oklahoma City, Oklahoma

My three criticisms were that the program has no way to fix errors at reconciliation time, that the manual lacks an index, and that it won't print addresses for window envelopes. I stand by all three.

It's true; you can use the edit function to correct a check. However, the reconcile function still needs a way to fix errors; I find most of my errors while reconciling. And although other users may not mind that the program can't print addresses, I would be very angry at a review that didn't mention this fact since I print 40 or 50 checks a month.—Donald Trivette

WHO DONE IT?

Your review of the *Lotus 1-2-3* add-in program *Write-in* ("Word Processing Ability," *PC Magazine*, January 26, 1988) states that Eric Shultz wrote the specs for the Add-In Manager before leaving Lotus to found Blossom Software. This is incorrect. I was the one who originated the idea of having an add-in manager for Release 2 and wrote both the specs and the production program. Eric's involvement was limited to the final debugging after I left to

> ■ I was the one who originated the idea of having an add-in manager for Release 2.

write @BASE. Any claims to the contrary by Eric are without foundation.

Don Selesky
Westford, Massachusetts

Lotus acknowledges that Don Selesky and also David McCall made important contributions, along with Eric Shultz, to the

Add-In Manager. The idea for the Add-In Manager came originally from the Lotus development team for Symphony; outside developers Paul Funk, Geoff LeBlond, and Bill Lynch approached Lotus and expressed interest in creating add-ins; Shultz, Selesky, and McCall then developed the Add-In Manager.—Ed.

OUT OF THE DARK

I am only a little embarrassed to admit that my PC hardware knowledge is limited. Although I had hoped your magazine would enlighten me, I was still feeling my way through terms such as dynamic RAM, static RAM, memory cycles, clock cycles, wait states, and memory caching. Then I read Winn L. Rosch's article "Anatomy of a 386" (*PC Magazine*, January 26, 1988), and I saw the light. It was not as condescending as some articles I have read that are geared to the beginning PC user, and yet not so haughty as others whose audience must be MIT computer-science master's-degree holders. Thank you Mr. Rosch, and thank you *PC Magazine.*

Kent A. Mezger
Cincinnati, Ohio

In recent article by Stephen Manes, he points out how MS-DOS is still too hard to learn and use even after many revisions ("Type 'Type': How's That Again?" *PC Magazine,* January 26, 1988). This is true, but many would agree that reading *PC Magazine* for a period of time makes the function of MS-DOS as well as other aspects of the IBM standard of computing more understandable. Articles such as "Anatomy of a 386" keep us well educated on the latest developments in this ever-changing technology. I look forward to learning and exploring how the new 386 micro chip and the OS/2 operating system will affect the way we use computers. Thanks to all the staff of *PC Magazine* for making personal computing more understandable.

John Carno
Elizabeth, New Jersey

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You only want the best. You want it first. And, you work hard to get it. When you choose Wells American's A★Star® microcomputers, that's exactly what you get. Not only the best, but also the first.

Wells American was the first to release a 12MHz AT class computer. The first with 14MHz. The first with a no-hassle 31 day money-back guarantee. And yes—we were even the first in business. We've been making microcomputers longer than IBM, Compaq® and Apple® In fact, we've been making them longer than *anybody*.

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Designer provides extensive text handling capabilities such as merging text files from popular word processing programs and supporting graphic and bitmapped fonts. You can edit text and even stretch and rotate it. And Designer supports all Windows-compatible fonts and downloadable fonts.

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■ LETTERS

TURBO POWER

Neil J. Rubenking's article on Turbo Pascal 4.0 (PC Lab Notes, *PC Magazine*, January 26, 1988) provided an excellent introduction—

> The answer to the DOS problem is to focus on it and solve it, learn the rudiments of the subject, and not moan.

duction to this powerful new programming environment. Keep up the good work—you always seem to deliver just what I need at the moment!

Douglas A. Kerr
Dallas, Texas

I thoroughly enjoyed your recent issue covering Turbo Pascal 4.0 (PC Lab Notes) and providing the PAINT program by Jeff Prosise (Utilities, *PC Magazine*, January 26, 1988). As always, your timing was right on the money.

Christopher H. Hall
Austin, Texas

HELP FILE HELP

Help! Although I really enjoy the PC Magazine Help Files that you've been publishing, I seem to be missing one. In the February 16, 1988, issue, you stated the Help File in that issue was sixth in the series, and yet I have only five in my possession. Am I really missing one, or did y'all make a misprint?

Thomas F. Hamlyn
Houston, Texas

Oops, you're right. The PC Magazine Help File in the February 16, 1988, issue was only the fifth in the series.—Ed.

REALLY NEAT

Quoting from Stephen Manes's column "Neatness: It Really Does Count" (*PC Magazine*, January 12, 1988):

> "Neatness is highly temporal. Many things were neat when they arrived, but

aren't anymore. The Tandy Model 100. The 10-megabyte hard disk. *1-2-3.* AT-class speed."

I don't know about the other items, but my Tandy 100 is still neat! I bought a Toshiba T1100 (they may have come out, but after one trip to Hong Kong I put it on a desk and it has stayed there ever since. The Toshiba and others like it aren't really portable—the Tandy 100 is. In fact, the 100 is still the neatest machine around for truly portable writing.

I. Switzer
Palm Springs, California

THE DOS SOLUTION

Stephen Manes's column "Type 'Type': How's That Again?" (*PC Magazine*, January 26, 1988) brought a smile of not-so-fond recognition, with its Abbott/Costello (consultant/client) keystroke-by-keystroke telephone conversation.

MS-DOS does indeed frustrate computer users, but I disagree with Mr. Manes's moral that "MS-DOS is too hard to learn and use." DOS requires relatively exact expressions, true, but so do most useful verbal instructions, recipes, or reports. Granted it takes some work, competent instruction, and a good book in order to use DOS, but the answer to the DOS problem is to focus on it and solve it, to learn the rudiments of the subject, and to moan or make excuses.

John T. Lowry
Billings, Montana

CORRECTIONS/AMPLIFICATIONS

The correct phone number of Boston Documentation Design (Connectivity Clinic, *PC Magazine*, January 26, 1988) is (617) 965-5300.

HOW TO WRITE TO PC MAGAZINE

Do you have a comment, compliment, or criticism about something you've read in *PC Magazine?* A question you'd like to open up to other readers? Then send your opinion to Letters to PC Magazine, One Park Avenue, New York, NY 10016, or through MCI Mail to PCMAGAZINE.

All letters become the property of *PC Magazine* and are subject to editing. We cannot publish letters that do not include a name, address, and phone number. We're not able to answer letters personally. ▣

■ MITT JONES

PC ADVISOR

Help in choosing among the ANSI-77 standard FORTRAN compilers for the PC, and in upgrading a standard five-slot PC with a 386 processor.

386'ING A PC

I've been considering trading up to a low-cost AT or installing a 386 motherboard in my old five-slot IBM PC—upgrades like this the better way to go?

Thomas J. Twardzik
Memphis, Tennessee

Which route you should choose depends largely on personal preference and how you use your machine.

Upgrading your PC to an 80386 machine offers several advantages. The obvious advantage is the increased speed. Your properly upgraded PC would easily outrun an 8-MHz AT in most situations. More important, however, is the flexibility a 386 machine would give you in the future. Though either a 286 or 386 machine will run OS/2, software manufacturers have already marketed other powerful environments, such as Microsoft Windows/386, MV/386, and DESQ-View/386, that take advantage of the awesome power of the 386 and run only on 386-based machines.

There are also advantages to buying a new AT machine, however. One obvious advantage is the newness of the equipment. Your PC's keyboard, hard disk (assuming you've added one), floppy disks, and other equipment won't last forever. Other advantages include more slots than the five in your PC and a faster hard disk. Overall, you'd have a system that operated more smoothly and that left you plenty of room to grow.

With that said and done, you've got sev-

eral attractive options no matter which route you choose. If you decide to install a 386 motherboard in your PC, a task that's surprisingly easy, your best bet is the Hauppauge 386 Motherboard ($1,495; Hauppauge Computer Works Inc., Commack, N.Y.; (516) 360-3827). The Hauppauge runs at 20 MHz and comes in a five-slot version for PCs and an eight-slot version for XTs.

As a much less expensive option, however, consider going with the Inboard 386/PC (Intel Corp., Hillsboro, Ore., (503) 629-7354)—a $995 board that plugs into one of your PC's slots and delivers 16-MHz performance. The Inboard won't boost overall system performance quite as much as the Hauppauge, and you won't get any 16- or 32-bit expansion slots, of course. But this excellent product offers more bang for the buck than anything else around.

If you opt for an AT compatible (IBM no

> **■ If you decide to install a 386 motherboard in your PC, a task that's surprisingly easy, your best bet is the Hauppauge 386 Motherboard.**

longer offers the True Blue AT), you've got countless attractive options. Peruse your back issues of PC Magazine for our frequent roundups and reviews of AT compatibles to find a machine in your price range that suits your needs. Our most recent feature concentrated on machines costing less than $1,500 ("The Cheapest ATs Ever," PC Magazine, February 16, 1988).

FORTRAN FOR THE PC

While reviews for BASIC and Pascal compilers abound, I am at a loss to find a FORTRAN compiler for the PC. My main concern lies in the completeness of the error messages and in adherence to the ANSI-77 standard. I am an undergraduate student majoring in mechanical engineering.

Herm Harrison
Cincinnati, Ohio

Three FORTRAN compilers for the PC deserve mention. All adhere fully to the ANSI-77 standard and add the popular extensions, such as IBM/VS and DEC VAX extensions. All also make use of similar error messages. Your choice will depend upon the cost and upon other features of the compilers.

Lahey Computer Systems Inc. (Incline Village, Nev.; (800) 548-4778) markets several FORTRAN compilers, each meant for a different class of user. The $95 Lahey Personal FORTRAN 77 offers the full ANSI-77 standard (though not the extensions) and an on-line debugger, but it limits program size to a maximum of 64K. F77L, the original of the Lahey line, is a more powerful version of its cheaper sib-

■ PC ADVISOR

ling and sells for $477. F77L supports most popular extensions to the ANSI-77 standard, offers a maximum program size of 640K (minus operating system), and supports interfaces to Microsoft Macro Assembler and Lattice C. An upcoming version will provide an interface to Microsoft C. Lahey also offers 16- and 32-bit versions of F77L that allow faster execution and support programs of virtually unlimited size.

Microsoft's extensive line of compilers includes Microsoft FORTRAN ($450; Microsoft Corp., Redmond, Wash.; (800) 426-9400; (206) 882-8080). Microsoft FORTRAN supports a maximum program size of 640K and includes Microsoft's popular CodeView debugger. Perhaps the biggest advantage this compiler offers, however, is its ability to interface to several compilers across the Microsoft line—Microsoft Macro Assembler, C, and Pascal, and QuickBASIC 4.0. In mid-Feb-

ruary, Microsoft is scheduled to ship Version 4.1 of the FORTRAN compiler, which will allow development of programs for the OS/2 environment.

Austec Inc. (formerly Ryan-McFarland

■ Lahey markets several FORTRAN compilers, each meant for a different class of user.

Corp., Rolling Hills Estates, Calif.; (213) 541-4828) sells its RM/FORTRAN compiler for $595. RM/FORTRAN ships with a sophisticated program development environment that takes a project management approach to applications development.

The environment includes an interactive editor and debugger and automates program compilation and linking. Maximum program size is 640K, and the compiler supports interfaces to Microsoft Macro Assembler and C compiler. Austec wrote IBM's FORTRAN/2 compiler, the FORTRAN compiler IBM now ships for OS/2 development. Austec will begin shipping its own version of that compiler soon.

Assuming that your finances are as tight as mine were as an undergraduate, your best bet may be Lahey's $95 compiler. You'll probably find all the features you need. And if you outgrow that compiler, you'll be able to take advantage of Lahey's $50 upgrade to the more powerful F77L compiler.

ASK THE ADVISOR

Send your questions to PC Advisor, PC Magazine, One Park Avenue, New York, NY 10016.

Y COMPARISON.

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PC MAGAZINE FIRST LOOKS

dBASE IV Getting a Major Overhaul and Speed Boost

PC HANDS ON

BY GENE SMILGIEWICZ

Editor's note: PC Magazine First Looks reviews and Hands-On features are always based on experience with a finished product. Previews are based on a hands-on experience with an early version of a product. When dBASE IV is released later this year, an evaluation of the final product's performance will appear.

Circa four score and seven months ago, Ashton-Tate brought forth its first version of dBASE. Since then, each new release has been greeted with al-

The Browse mode will have more than just a mere look at a dBASE IV file. Searching, appending, and deleting of records will be possible through the pull-down menu. You will be able to adjust field widths interactively.

most as much criticism as praise.

It looks like Ashton-Tate may finally do it right when dBASE IV is released later this year. With a new interface and over 200 new or improved features, IV will be 100 percent compatible with III Plus programs and files. Performancewise, IV-played applications will run rings around III-based versions with speeds comparable to FoxBASE and Clipper. The programmer-oriented Developer's Edition may even win back developers who have opted for clones.

To start off, the III Plus Assistant has been replaced by the

New $725 R:base Understands Limited SQL and Runs Faster

PC HANDS ON

BY NEIL J. RUBENKING

Microrim's R:base has come a long way. Series 4000, 5000, and System V steadily added power and speed to the product. The latest version, R:base for DOS, includes SQL (Structured Query Language) support and sets the stage for an OS/2 version, due out in a few weeks, that will match this version, feature for feature.

R:base for DOS lets you create and test a database or appli-

cation without leaving the system. Moving from the database itself to the other modules (Forms, Reports, editor, and so on) is faster than in System V. However, users of common word processing programs will find the RBEDIT editor cumbersome.

R:base for DOS allows logical grouping of conditions in Where clauses using parentheses. Previously there was no easy way to select, say, residents of Paris, Texas, or San Jose, Illinois. Now you just write Where (state = TX AND

city = Paris) OR (state = IL AND city = San Jose).

R:base for DOS uses the same file structure as R:base System V, and all the old commands still work. You may need to make some minor changes, but for the most part your System V databases and applications will work with the new version.

Prompt By Example makes using R:base easy. If you know what command you want, type PROMPT followed by its name at the R> prompt. If you know

dBASE IV

(continued from page 33)

Control Center, a much more elegant and effective interface. Consisting of a menu bar atop a "work surface," its style of screen organization, along with consistent function-key assignments, flows through underlying utilities.

The Control Center relies upon "catalogs," files that define sets of associated databases and their ancillary format and program files. Not merely a holdover concept from *III Plus*, catalogs enable the Control Center to present a complete overview of the "objects" constituting an application.

Cataloged files are listed alphabetically, according to their function, in task panels on the Control Center's work surface. From left to right are dFILES, Queries, Screens, Reports, Labels, and Applications panels. Each panel's list is headed by a "<create>" option.

When you select—point-and-shoot style—any object in a task panel, the Control Center activates a relevant utility or responds with a dialogue box to determine further action. For example, selecting <create> in the dFILES panel initiates the menu-driven file definition procedure; selecting an object, then pressing the Del key lets you specify that the object should be removed from the catalog or deleted entirely.

The Control Center handles multifile relations and operations easily. From the Queries panel you can invoke the *Para-dox-like* Query By Example (QBE) processor that makes full use of *IV*'s new multiple-"child" capability. You specify the files to select, fields to project, and how files are to be joined to create a virtual database including only qualified elements. These "logical" views of data can be sorted, filtered, summarized, even updated.

From the Reports panel you will enter a world hitherto unknown to *dBASE* users: a decent report writer. Using a selected database or multifile view as a basis, you visually lay out columnar, form-based, or mailmerge reports. Your reports can

consist of an introduction, page headers and footers, numerous group headers and footers, a very flexible detail line, and a summary page. These seven types of "bands" can include text, database fields, and calculated fields. Numerous font and attribute options are also available. If you just want a simple report, choose the "Quick Layouts" option from the Layout menu to have *IV* do everything for you.

This approach is carried over to the Forms and Labels utilities. When designing data entry screens, you will not only have

space, will now be editable.

IV's ApGen makes its pitiful predecessor seem Stone-Age in comparison. It seems capable of generating truly complex application programs. The Developer's Edition even includes a template processor to guide its code writer according to your style and preferences.

You select database and format objects and specify the operations to perform. Resulting applications can have a handy customized interface utilizing customized sign-on screens, menus, pick lists, color, windows, and user-defined help.

The report preparation facility in dBASE IV is being greatly improved. Field positions can be panned onto a template, and field names can be changed for the report.

control over the placement of fields and descriptive text, you will also be able to specify editing and validation criteria. Memo fields can actually be displayed properly. You can use a Quick Layout option to have *IV* set up a basic screen that can be altered easily.

Whenever you build a new format or query definition, the Control Center generates short, modifiable *dBASE* programs. You can tie these objects all together in the Control Center's Applications panel.

When you elect to create an application program, you can do so from scratch or automatically. Those who write code in the traditional manner will appreciate the new program editor with its search and replace, block manipulation, and 1,024-character line lengths (the new limit for command lines). Large files, limited only by disk

Even the Quick Application option generates impressive-looking programs with a minimum of interaction.

dBASE IV now supports the IBM SAA (Systems Application Architecture) standard for SQL (Structured Query Language) as implemented in IBM's DB2 and SQL/DS, adding another 100-plus commands to the language. You can set up your applications where both dBASE- and SQL-created files are used by programs intermixing SQL statements with a large subset of *dBASE* statements. You can also operate SQL from the dot prompt, switching from *dBASE* to SQL mode.

Language and environment extensions now permit 2,048 memory variables, 255 fields per record, 1,000-character command lines, and 99 open files (only ten .DBFs, though). Programs can now include user-

defined functions and two-dimensional arrays.

Thanks to SQL, *IV*'s multiuser features are light years ahead of *III Plus*'s, with automatic record and file locking with dynamic screen refresh, eight-layer password protection, and data encryption. For the *pièce de résistance*: transaction processing mode with roll-back capability. Not only can you recover easily from a failed lock condition, you can even restore data and index files corrupted during a power interruption or network failure (or so Ashton-Tate says).

This new code, when first invoked, will be run automatically through the new, built-in compiler. The intermediate object code files created are subsequently executed more quickly than its interpreted source code. Developers can create stand-alone executables with the advanced version.

dBASE IV will need 640K RAM. In my experience with the beta is any guide, you will have to unload all your memory-resident programs if you want to avoid "insufficient memory" roadblocks. Naturally, *IV* will require 2MB RAM under OS/2.

dBASE IV is scheduled for release by July 31 with a $795 list price; an OS/2 version is scheduled to ship soon after. A LAN Pack for five network users will run $995. The Developer's Edition will set you back $1,295!

Ashton-Tate has dealt with most of the major deficiencies of *III Plus* and thrown in a few forward-looking features on its own. I haven't even mentioned the new macro capabilities, expanded import/export options, and DOS shell. Or the advanced debugger and the load of new financial, statistical, and math functions.

However I have to remain somewhat skeptical about how well all these improvements will be implemented. Every major new *dBASE* release has been fraught with bugs and anomalies. We can only hope that Ashton-Tate transcends its track record and delivers a product that is worthy of the design effort that went into it.

R:base
(continued from page 33)

only the general nature of the task, hit Esc at the R> prompt to get into the PBE menu system. Here you select topics such as Query the Database or SQL commands.

When you've chosen a command, R:base prompts you for every argument to that command. If the argument is a table or column name, R:base presents a list for you to choose from. As you answer the prompts, you build a command at the top of the screen. When the command is complete, you check for accuracy and then execute.

Express modules automate the tasks of creating databases and applications. Define a database with Definition Express, build its input forms with Forms Express, control the output with Reports Express, and bind the whole together in an application program with Applications Express.

The new Developer's Express module consists of an enhanced version of the CodeLock tokenizer, RComp, and a runtime module for R:base. RComp turns an R:base command file into a binary file, and RRun executes that file. RComp speeds execution by analyzing the program at compile time (the R:base compile does not produce standalone .EXEs, just tokenized R:base code). For example, it caches syntax errors and converts flow-control commands like While, If, and GoTo into absolute references. As a result you cannot use all R:base commands in compiled applications. The Developer's Express that comes with R:base is strictly for your own use. Microrim will soon release Developer's Express Unlimited, which will allow you to make an unlimited number of copies of the runtime module for distribution.

R:base for DOS incorporates 15 important SQL concepts into the R:base language. For example, the new Grouped By element allows you to get information about classes of objects with a Select command. If your application steps through a data-

base using a Pointer and variable assignments, you can speed things up with the new Declare and Fetch statements. And naturally you can call the SQL functions under Prompt By Example.

The security system is more precise—you can separately specify who may add data, who

may delete data, and who may alter existing data.

The standard R:base for DOS package serves up to three concurrent users on a network. You can purchase six-user and unlimited-user versions for a higher price. R:base guards against more than one user modifying the same data at once,

R:base for DOS can call SQL commands via Prompt By Example selection. Unlike the dBASE language, R:base programming syntax had no existing conflicts with SQL, so the SQL commands are easily mixed into R:base queries.

and the detailed SQL security system allows many distinct levels of access.

SQL Commands and Their R:base for DOS Counterparts

SQL command	R:base equivalent	Description
ALTER TABLE	EXPAND	Add column to table
CREATE INDEX	BUILD KEY	Create key index
CREATE TABLE	TABLES	Define a table
CREATE VIEW	VIEW	Define a view
DECLARE CURSOR	SET POINTER	Set a row pointer
DELETE	DELETE ROWS	Remove rows from table
DELETE (w/ GRANT/REVOKE)	MPW	Control removal of row data from table
DROP INDEX	DELETE KEY	Delete key index
DROP TABLE	REMOVE TABLE	Delete table
DROP VIEW	REMOVE VIEW	Delete view
FETCH	NEXT	Advance row pointer
GRANT	PASSWORDS	Give access privileges
GROUP BY	NONE	Get info on a class of elements
INSERT	LOAD	Add data to table
INSERT (w/ GRANT/REVOKE)	MPW	Control adding of row data to table
LIST ACCESS	NONE	Display current access permission for all users
ORDER BY	SORTED BY	Specify order of rows displayed
PUBLIC	NONE	Allow all users access to table or view
REVOKE	RENAME MPW/RPW	Remove access privileges
SELECT	SELECT	Display row data from table
SELECT (w/ GRANT/REVOKE)	RPW	Control viewing of row data from table
UPDATE	CHANGE	Change value of columns
UPDATE (w/ GRANT/REVOKE)	MPW	Control changing of column data in table

MS-DOS Encyclopedia: One-Stop Reference to Every DOS Version

BOOK REVIEW

BY ROBERT HUMMEL
AND GUS VENDITTO

DOS, in all its incarnations, can lay claim to being the most widely used software on the planet. Not content with that, Microsoft wants to make DOS the most heavily documented piece of code, as well.

To that end, Microsoft's publishing wing, Microsoft Press, set of 2 years ago on a project requiring 20 man-years worth of effort from 14 writers, 53 editors, and 65 advisors, leading to *The MS-DOS Encyclopedia*, a 6.73-pound, 1,570-page compendium of everything Microsoft and its advisers could think of saying about the Disk Operating System.

The Encyclopedia starts with a fascinating introduction that traces the history of DOS, starting with Bill Gates' and Paul

Allen's first programming for the MITS Altair, and detailing the steps that led to PC-DOS.

Don't confuse this edition with Microsoft's abortive first effort at producing a comprehensive DOS reference in 1986, which was so error-ridden it had to be recalled and abandoned. This work is authoritative and accurate in its gathering of DOS system calls, command syntaxes, and version minutiae, like the file control block structure. .EXE file header formats, and instruction sets for the 8088, 286, and 386.

Those who have read IBM's

DOS manual will find the explanations of DOS commands and options much improved. *The Encyclopedia's* alphabetical syntax listing notes the commands, switches, and options that were introduced with one

version or another.

It's insightful in a number of chapters, where legends like Ray Duncan, Charles Petzold, and Van Wolverton shed light on side topics like "Structure of an Application Program" and

From the historical introduction to the encyclopedia, a reprint of an early Microsoft outline of the steps that are required to get DOS running on the PC. Copyright 1987 by Microsoft Press; reprinted with permission.

"Writing MS-DOS Filters."

This massive book is not just a dry reference. To illustrate the nuts and bolts of DOS programming, page after page of program listings are included. Examples of device drivers and interrupt handlers are provided in C and assembly code, sprinkled liberally with comments. And Microsoft doesn't pass up this chance to steer your attention toward the *Windows* environment, with a chapter devoted to its structure and the techniques needed to write for it. Most of the code is available on disk for an extra charge.

Experienced DOS programmers, who may already own the DOS *Technical Reference* manual and some of the better reference works (Ray Duncan's *Advanced MS-DOS*; Peter Norton's *Programmer's Guide to the IBM PC*), may find the book unnecessary. It will prove unwieldy as a desk reference, and it doesn't offer much new material. A thorough reading will turn up a few elusive tidbits about disk partitions and DOS structures, for example, but it will take a lot of effort.

Microsoft Press seriously blundered by printing the code listings in light-blue ink. The contrast is so low that after a few hours of reading, even the sharpest eyes will have difficulty following the code.

If you like the idea of a one-stop DOS reference book, then this book is for you. But if you've already got a full DOS library, this work will seem redundant.

Revving Up the 286 Processor: New ATs Run from 6 to 16 MHz

PC HANDS ON

BY JONATHAN MATZKIN

AT-class machines—PCs built around a 286 processor and offering both 8- and 16-bit expansion slots—slip a few notches further from the state of the art every time a new 386 PC is released. As they slip, they become more of a bargain for offices in which low prices and faster-performing ATs are a top priority.

New machines from Leading Edge Hardware Products, Dell Computer Corp., and Wells American represent the range of choices available. The Leading Edge Model D2 builds on the success of the original, 8088-based Model D, while the PC's Limited System 200 is Dell Computer Corp.'s effort to correct some of the limitations in its earlier 286s. The Wells American A*Star 16-MHz 286 is blindingly fast but is limited in its hardware compatibility.

The Model D2 is the successor to Leading Edge's Model D, one of the first clones that could seriously be called compatible. The D2's $1,495 price tag includes a 1.2MB floppy disk drive, an EGA/CGA/Hercules/MDA-compatible graphics card, and a monochrome monitor. The base price also buys you 640K of RAM, a 200-watt power supply, and one serial and one parallel port.

The D2 also comes with one of the best keyboards to be found on a non-IBM machine. The keys have a "clicky" tactile response that is considerably more comfortable than the usual mushy clone keyboard.

Adding a 30MB hard disk boosts the system price to $1,995, while a 65MB system will set you back $2,495.

The small-footprint PC is narrower and deeper than a standard AT. It has four 16-bit and two 8-bit slots.

At 10 MHz, the Model D2 ran about even with the PS/2 Model 60 in our benchmark tests. The system can run at 6, 8, and 10 MHz.

The D2 isn't a world-beating performer, but it offers solid AT power and a complete configuration at a very attractive price.

Dell Computer's PC's Limited System 200 replaces the company's 8- and 12-MHz offerings. The company has overhauled the look of the system and many of its internal components. The LED "Smartvue" indicator panel is gone from the front of the machine, and Dell has joined the rest of the civilized clone world by dropping its proprietary BIOS.

The Phoenix BIOS found in its place offers support for 3½-inch floppy disk drives—the lack of which was a key failing in earlier PC's Limited 286s.

The System 200 runs at selected speeds of 12.5 and 6.25 MHz. The I/O bus runs at speeds of 8.3 and 6.25 MHz, to avoid hardware-compatibility problems at the higher clock speed.

The System 200 will have a version of OS/2 that will be available from Dell. Running at 12.5 MHz, the System 200 solidly outperforms the PS/2 Model 60 in our benchmark tests.

A basic monochrome system sells for $1,799. That includes 640K RAM, a 20MB hard disk, two serial and parallel ports, and a 200-watt power supply.

The Wells American 16-MHz A*Star is the fastest AT compatible you are likely to see. It's the fastest of the three machines benchmark-tested here

and leaves the PS/2 Model 60 in the dust.

Unfortunately, the A*Star's I/O bus runs at processor speed, and since many existing add-in cards for the AT bus won't run properly at speeds above 10 MHz, hardware conflicts are a problem. So you may have to replace or omit some of your hardware to take full advantage of the system's speed.

A basic 16-MHz configuration, with a 1.2MB floppy disk drive, a 21MB hard disk, and a meg of RAM, costs $2,195. A 220-watt power supply is standard.

List Price: Leading Edge Model D2, $1,495. Leading Edge Hardware Products Inc., 225 Turnpike St., Canton, MA 02021; (800) 343-6833.

CIRCLE 453 ON READER SERVICE CARD

List Price: PC's Limited System 200, $1,799. Dell Computer Corp., 9505 Arboretum Blvd., Austin, TX 78759; (512) 338-4400.

CIRCLE 454 ON READER SERVICE CARD

List Price: Wells American A*Star 16-MHz 286, $2,195. Monitor additional. Wells American, 3243 Sunset Blvd., West Columbia, SC 29169; (803) 796-7800.

CIRCLE 455 ON READER SERVICE CARD

PC LABS
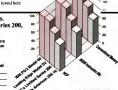
Benchmark Tests: IBM PS/2 Model 60 vs. Wells American 286 16, PC's Limited Series 200, and Leading Edge Model D2

The speeds at which these machines ran their 286 processors were responsible for the performance differences on these tests. Higher clock speeds did cause some compatibility problems in machines in which the expansion ran above 10 MHz.

Performance Times

(Times given in seconds)

	NOP	80286 Instruction Mix	Conventional Memory
IBM PS/2 Model 60	3.36	7.14	1.04
Leading Edge Model D2	3.35	7.09	1.04
PC's Limited Series 200	2.69	5.60	0.83
Wells American 286 16	2.09	4.29	0.61

The NOP benchmark test is designed to measure raw clock speed and memory access time while minimizing differences in microprocessors and the effect of memory caching. This test executes almost nothing but NOP ("No Operation") machine code instructions in a big 128K loop.

The 80286 instruction Mix benchmark test measures the time it takes to execute a selected series of processor-intensive tasks. The test program uses 80286 instruction code. These instructions are a subset of the total processor instruction set.

Relative Times
(IBM PS/2 Model 60 = 100)

The Conventional Memory benchmark test allocates 256K of conventional memory and treats it as a series of 64-byte records. Then, 16,384 random records are read into and written from this memory. The result shown is the average of the read and write times.

Mt. St. Helens Can Teach Us A Lot About Hard Disks.

Like a dormant volcano, your hard disk is a disaster waiting to happen. It can blow at anytime. And most people don't do anything to protect themselves.

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*With PC AT or equivalent. XT machines will take longer.

easy to use graphic display and support for DOS 3½ or 5¼ inch floppies, prompted PC Magazine to nominate FASTBACK PLUS for its coveted Technical Excellence Award. The same technical excellence that made FASTBACK the all-time bestselling backup utility. Don't trust your data to anything less.

A Minute A Day Keeps Disaster Away

PIPELINE

Top Ten Sellers

1 Lotus 1-2-3 2.01
Lotus Development Corp.

2 J.K. Lasser's Your Income Tax 1986
Simon & Schuster Software

6 TurboTax Personal/1040-1987
ChipSoft Inc.

4 PFS:First Choice 2.0,
Software Publishing Corp.

6 dBASE III Plus 1.1
Ashton-Tate Corp.

6 WordPerfect 4.2
WordPerfect Corp.

7 PFS:First Publisher
Software Publishing Corp.

8 PC Tools Deluxe
Central Point Software

9 Quicken 2.0
Intuit

10 Sideways 3.2
Funk Software Inc.

IN PERSPECTIVE

The Top Ten Sellers list ranks PC business programs according to their sales performance in the last week of a 5-week period based on unit sales. It also tracks programs' rankings over time, in this issue (reading left to right) from January 11 through February 19. A 5-week history is charted to give a sense of a program's sales strength over time. Dramatic shifts in a particular program's ranking may be the result of sales promotions conducted by individual retailers. Or seasonal factors, such as end-of-year-budget purchase decisions, may play a large role in the performance of a particular program in any period. More than 12,000 individual locations contribute to the list.

Sales information compiled by Ingram Software Inc.

Rankings are based on net sales by unit; returns are subtracted from gross sales.

What a difference an announcement makes. Last issue, *dBASE III Plus* had dropped out of the Top Ten Sellers, probably because of a wait-and-see attitude that resulted from speculation that Ashton-Tate would soon announce the next version. Well, the announcement came, and *dBASE* sales bounced right back, thanks to the promise of a nominal upgrade cost for new purchases. Now Ashton-Tate can calmly work on finishing *dBASE IV* (see Preview on page 33), and users can plan on benefiting from better report writing, applications generating, and compiling. So everyone's happy, except for the burned souls who put their money down just before the February 17 cutoff and have to upgrade for $175 instead of $30.

IBM Breaks the Ice

Cynical IBM watchers may be quick to discount the impact of the

SURVEY

We called this survey "Dreams vs. Reality." We wanted to see how much the cost of hardware was holding people back from satisfying their wildest desires. Not much, as it turns out. Generally, people plan to buy that better hard disk or VGA board.

Some respondents couldn't play along. "I am unable to separate cost from

Cost aside, which would you most like to add to your PC?

Legend:
- Bigger and faster hard disk
- Faster CPU
- Better video graphics
- Faster modem
- Tape backup
- CD player
- More RAM
- Laser printer
- Color printer
- Plotter
- Network adapter
- Other

reorganization that recently swept through IBM, but from where we sit there are indications that a sense of openness and market responsiveness may yet creep into IBM's philosophy.

Glasnost will not come easily to IBM, but the blue troops have been struggling mightily to map out their near-term strategy without giving away all of their secrets.

At *PC Magazine*, we usually pass on the speculation in favor of pounding on the hardware, but some of the news trickling out about events surrounding the changes in IBM's infrastructure holds great promise for hardware fans.

So far, IBM has said that the 8088 and 8086 will have no further life in the PS/2 line. New entries will be based on Intel's 16- and 32-bit processors, and by the end of 1989, the entire line will be built around 386s. No more old-bus machines will be built; the Micro Channel will reign supreme.

Because IBM will be throwing its full weight behind OS/2, a few other changes must be made to its PS/2 line. For example, the Model 50 will need to be bolstered in order to run OS/2, Version 1.1 (with the Presen-

tation Manager), at acceptable levels (the Extended Edition can easily chew up 20MB of disk space before the first application is run). So the Model 50 will be sold with a larger and faster hard disk and more memory (4MB of RAM is the minimum OS/2 1.1 will require). To speed things up, the new Model 50 will run without wait states.

Following the success of 3Com and others, IBM will introduce a diskless version of the Model 50 for networks.

Other changes we'll see within a year are PS/2s that incorporate the Hi-res 8514A graphics controller on the system board *and* a 12-MHz graphics coprocessor for faster windowing.

IBM's plans for OS/2 include a System 36 version and a

target of 1,000 OS/2 programs running by early next year. Last time we counted, there was only one OS/2 application actually being sold (*ThinkTank* from Symantec), with many more promised (a few of them behind schedule).

To help get the ball rolling, IBM will soon release *Display-Write* for OS/2.
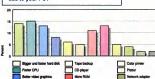
(If you have ever wondered why IBM software for the PC never made it big, here's one clue. A New York company, Wertheim & Associates, is selling Hewlett-Packard LaserJet Series II drivers for *Display-Write 4*. The cost? A mere $500. We don't know if the new *DisplayWrite* will concede that people do actually connect PCs to printers that are not made by IBM, but we wouldn't bet on it.)

IBM also confirmed that an enhancement to DOS with pull-

April announcements have become something of a tradition at IBM, so we should be hearing firm details on the above in a matter of weeks.

— Gus Venditto

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value. 'Money aside' is nonsense," said one. Others accused us of thinking too small: "Geeezz! 'Cost aside' means a Cray, guys. Think *big*!"

If our responses are any indication of consumer interest, it's no wonder that color printing still lags behind other output devices: only 2 percent chose it.

Considering the cost, which will you add to your PC?

Legend	
■ Bigger and faster hard disk	☐ Tape backup
■ Faster CPU	☐ CD player
■ Better video graphics	■ More RAM
■ Faster modem	☐ Laser printer
☐ Color printer	
☐ Plotter	
☐ Network adapter	
☐ Other	

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Announcing Silverado,™ a remarkable new database for Lotus 1-2-3 or SuperCalc® 4 users. You'll feel right at home with Silverado because it works within your spreadsheet and has the same familiar commands and interface. As an extension to your spreadsheet, Silverado makes your everyday tasks much easier and faster. As a powerful database, Silverado takes you far beyond the capabilities of the spreadsheet:

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* Easily search and filter your data.
* Import data from dBase III, text, and 1-2-3 or SuperCalc4 files (SuperCalc4 version coming soon).
* And instant overviews with revolutionary new Database Outlining.™

"Silverado is a wonderful database add-in. Its reporting features are quite sophisticated . . . I'm a fan of outlining [and] applying this to databases is a great idea . . ."
—InfoWorld, December 7, 1987

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Windows present data from multiple databases

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4Views Plugs a Slew of DBMS Functions into Your Worksheets

BY MERV ADRIAN

Turner Hall Publishing has weighed in with what must be the sixth *1-2-3* database add-in. *4Views* lets you up your *1-2-3* database with Table, Forms, Crosstab, and Report Views, leaving the data in the *1-2-3* file while doing its work.

Table View presents an attractive appearance, with "field names" at the top, and lines between the columns. You can add, delete, and change records. Analytical query tools in Lotus menu fashion are provided. While the query function isn't as striking as the "database outlining" in Computer Associates' *Silverado*, it permits field computations, filtering, sorting, and direct record retrieval by key.

4Views expressions are compatible with *1-2-3* syntax, including intelligent use of function keys. Report Views and Crosstab Views permit other levels of analysis, sorting and summarizing one variable by another. Nine @ functions and eight @ PRINT functions facilitate using *4Views* within *1-2-3*

In 4Views' Xtab function, the Analysis Field tells 4Views which field to summarize; the Analyses Operator and Divisor determine the way data will be summarized.

macros. Views are named and saved in files with the extension .4VW.

The name of the View itself doesn't appear anywhere on the screen, a serious omission, especially if you have multiple Views in a given application.

Files may be joined relationally on common fields. After the JOIN has been done you may delete fields from the View, including the fields on which the JOIN is based!

The manual is the biggest failing. The mostly excellent tutorial comes after seven chapters and is completely impenetrable on the subject of report customization. A new manual will be distributed free to registered users in May.

Graphics Utility Performs Gray-Scale Conversions

BY TOM STANTON

Preproduction in desktop publishing remains a haphazard affair. Previewing .PCX files with *PC Paintbrush* takes time, and you can't view the entire image. Screen capture may be common, but converting color to gray scales automatically is not. Text previewing could also be improved: most utilities are limited to screen-by-screen paging and 25 lines in EGA text mode.

Collage, an assortment of utilities from Inter Media, comes close to answering these preproduction needs.

SHOW lets you load and view .PCX files in color or black and white without running a paint or publishing application. SHOW accepts wildcards so you can review large groups of files screen-by-screen. There's also a zoom mode that doubles resolution, based on the file size, for examining detail. The file header identifies the file name and path so you know what you're viewing. SHOW should be standard issue with every desktop publishing package on the market.

SMOOTH lets you view text by scrolling smoothly, rather that screen-by-screen, and includes a search string facility and a 7/8 bit toggle for high-order bits.

SNAP, a memory-resident screen capture program, uses 24K RAM and is called up using Shift-PrtSc. Its menu has print screen, screen save, screen palette, and a calendar.

Using arrow keys, you can change colors in any application before saving the screen. SNAP will leave the application in the colors you select if you exit without resetting, so you can try different screens in the selected palette.

SNAP's Gray Scale .PCX mode saves in black and white, converting colors to gray scales; there's also an Inverse Gray .PCX format. The gray scales use 2-bit arrays, so there are only five gray levels possible. Images with large areas of similar color tend to blend together and lose gradation, so SNAP may have limited use on some color graphics. I found I could improve some screens using the palette utility to increase color contrasts, but even here there are only so many choices. One side benefit of the five gray scales is that SNAP files are much smaller than the average .PCX file and load faster in *Ventura Publisher* and *PageMaker*.

Collage utilities are easy to use and well documented. They provide a good set of no-non-sense tools for publishing. Enhanced gray scaling in SNAP would be useful, but otherwise it holds up well against its competition.

$100 Sourcer Produces Order out of Chaos: Disassembles, Documents Machine Code

PC HANDS ON

BY ROBERT L. HUMMEL

Sourcer, from V Communications, creates documented assembly language source code and listings directly from either memory or from DOS program files with ease and intelligence. Not just a tool for assembly programmers, Sourcer doesn't require that you have a degree in computer science to operate it. In fact, you can turn out readable source code for almost any program without knowing a thing about assembly language at all!

Already destined to become a classic in the programming community, Sourcer offers significant benefits to many classes of users. For example, it can be used to clarify undocumented code or create source code when the original has been lost or is unavailable. A program suspected of being a "Trojan horse" or of containing a "virus" can be disassembled and examined at the source code level for suspicious routines.

Simply put, an assembler (like MASM) translates human-readable assembly language instructions and data (assembly

You can set Sourcer's analysis options—number of passes, remark printing, listing of segments—from the single-screen control center.

code) into their compact, machine-executable equivalents (machine code). Conversely, a disassembler performs the opposite service: translating machine code back into assembly code. Unlike BASIC or Pascal, in which a single instruction can generate many lines of machine code, assembly language enjoys a 1:1 correspondence between the source code instructions and the resultant machine code,

making recreation of source code possible.

But as anyone who has ever looked at a program with DE-BUG can tell you, assembly language programs can be horribly complex, containing mixed code and data, which makes a simple disassembly virtually impossible. Sourcer overcomes this problem using the same method that a programmer might: by tracing through the execution of the target program and watching what it does. As more information about the program is collected, the analysis becomes more refined. The tar-

get program may be examined by Sourcer's execution simulator up to five times in a single run. Each simulation provides a better picture of the actual program operation.

Undocumented assembly code can be cryptic and unreadable. This isn't a problem with Sourcer. In addition to producing the assembly code, Sourcer actually adds comments to the listings! The comments include

extra information on data areas accessed, I/O port activity, and some of the more-complex assembly instructions, as well as identifying most BIOS and DOS function calls by name. Be aware, however, that while all these comments help you see *what* the program is doing, they don't tell you *why*. Analysis of that sort is still in the human domain. Sourcer's biggest benefit is that it performs the initial, mostly mechanical analysis of a program for you. On a large program, this savings can add up to days or even weeks of programming time.

Once the initial Sourcer run is completed, programmer insight can be added via a definition file that allows the disassembly process to be refined, comments added, data structures specified, and locations and variables named. The definition file syntax used in the version of Sourcer that I tested (1.6) was unnecessarily complex. But a new version of the program, currently in beta testing, that will allow more powerful and greatly simplified syntax should be available by the time you read this.

Sourcer can disassemble the DOS .COM and .EXE program file formats, overlays, device drivers, and other binary file types. Many of these file types are recognized automatically.

Processor instruction sets supported include 8086/87/88, 80186/188, 80286/287, and V20/30. The protected-mode 80286 instructions are also fair game, allowing disassembly of OS/2 programs.

In addition, with the purchase of the optional BIOS Pre-Processor, complete, commented source code listings of the BIOS for almost any IBM-compatible computer can be generated. Because the entry points and functions of many portions of the BIOS are known, these are identified on the listing automatically. Hackers should note that since IBM is no longer supplying a BIOS listing for their PS/2 computers, this may be the only way to get one. Note, however, that in the current version, the instructions unique to the 80386/387 processors are not supported.

If you've ever had to examine undocumented assembly code or were curious as to how a program worked, then Sourcer is a must. Now that I've tried it, Sourcer is up there on my list of programs that I simply won't do without. The technical support is great, and with a 30-day, money-back guarantee, you can't go wrong.

> A program suspected of being a "Trojan horse" or of containing a "virus" can be disassembled and examined at the source code level for suspicious routines.

Harvard Graphics 2.1 Packs More Features

BY ROBBIN JURIS

If there was one business graphics task that *Harvard Graphics*, Version 2.0, couldn't do, you would have been hard-pressed to find it. But the mechanics of chart preparation aside, Version 2.0 couldn't correct a problem that can undermine even the most well-thought-out presentation: typing and spelling errors.

With Version 2.1, Software Publishing Corp. has gone a long way toward solving this problem by adding a 77,000-word spelling checker. The vocabulary of this spelling checker is more extensive than those you'll find in many word processors, although it doesn't come close to the current leaders. Like most word processors, *Harvard Graphics* lets you create a personal dictionary of specialized words.

But that new feature is only one of Version 2.1's enhancements. Software Publishing has added 200 more symbols to the package's clip-art library.

Version 2.1 also lets you save charts as symbols, which means that you can alter the size, shape, and individual attributes of a chart; move legends, labels, and pie slices; and situate your chart anywhere on the screen in the same way you would a symbol. A data table feature lets you include in tabular format *x*-axis data values for a given *x*-axis point in a bar, line, area, or high/low/close

Supply Costs
monthly landings
from Alaskan distributors

The map of Alaska is one of Harvard Graphics's new symbols.

chart. If you want to change the size of the *x*-axis and *y*-axis labels in your charts, a new feature lets you do that as well.

This upgrade adds support for General Parametrics's VideoShow, for producing slide shows and screen shows; Kurta's IS/ONE Tablet, for modifying images; and three laser printers—IBM's Pageprinter and NEC's LC-860 and LC-890. You can export charts and sym-

bols to such desktop publishing programs as *PC PageMaker*, *Ventura Publisher*, or any program that can read encapsulated PostScript (EPS) files.

Plug-in PostScript for LaserJet II

BY MITT JONES

For all the talk about PostScript, you'd think a PostScript printer was some gee-whiz gizmo with gold cogs that has to be christened with Dom Perignon as it leaves the factory.

QMS's JetScript PostScript Controller, distributed by The Laser Connection, reminds us that all it takes to print Post-Script is a laser printer, a Post-Script interpreter with a dedicated processor, and lots of RAM. If you've got an HP LaserJet series II, JetScript adds the other necessities.

The Motorola 68000 processor and 3MB RAM come on a full-length board that installs in your XT or AT. A small adapter

card installs into the LaserJet II's slot to receive the PostScript signals from your system.

JetScript includes Adobe's PostScript interpreter (Version 47.2) and the same 35 fonts Apple ships with its LaserWriter Plus and LaserWriter II. Once it's up and running, you can use your LaserJet series II either as a PCL printer—as you normally would—or as one of the fastest PostScript printers around.

JetScript, coupled with a LaserJet series II, is the fastest PostScript printer we've tested. JetScript and Apple's Laser-Writer II NT depend on a Motorola 68000 processor to handle the PostScript interpreter, but each runs the processor at a different speed and transfers data at a different rate.

Apple's II NT runs at 12

MHz and zero wait states, fast in comparison with the old LaserWriter Plus. But JetScript runs at 16 MHz with one wait state and drastically improves the data transfer rate by staying away from the 9,600-bps COM port in favor of its own high-speed video transfer.

The two printers finished our single, single-font benchmark tests nose to nose, with both clocking in at 7.4 pages per minute. But in a real-world PostScript test—printing a four-page *PageMaker* document scattered with images and graphics on an 8-MHz IBM PC AT—JetScript flexed its muscles. JetScript printed the file in 6 minutes 43 seconds initially and 4 minutes 33 seconds once the fonts were loaded into the cache; the LaserWriter II NT

performed the same test in 9 minutes 18 seconds and 6 minutes 39 seconds, respectively.

All in all, JetScript is the answer to your problem if you need PostScript but already own a LaserJet series II.

NEW ON THE MARKET
by Michael W. Muchmore

Sophco Touts Force III As the Fastest dBASE Compiler Available

Sophco Inc., of Boulder, Colorado, claims its Force III is twice as fast as its nearest competitor among the currently available dBASE compilers.

It also claims greater compatibility with *dBASE III Plus*, and says that its compiled .EXE files are a tenth the size of those of other compilers. This is because the compiler includes newly needed subroutines, and those are in very compact assembler.

The compiler allows for 2.1 billion records per database, 2,048 fields per record, and as many arrays as memory can support.

Other features you get with Force III are I/O directives, trig and string functions, sound, for ...next loops, extended data types, user-defined functions, and the ability to link to languages that produce .OBJ files.
List Price: Force III, $129.
Requires: 256K RAM, one disk drive, DOS 2.0 or later. Not copy protected. Sophco Inc., P.O. Box 7430, Boulder, CO 80306; (303) 444-1542.

CIRCLE 442 ON READER SERVICE CARD

Summagraphics Makes Bit Pad Plus, $495 Electrostatic Tablet for CADD, Graphics

Summagraphics Corp., of Fairfield, Connecticut, set a standard for tablet graphics input devices with its Summa-Sketch. Bit Pad Plus, its latest tablet, uses capacitive electrostatic charge ratio technology instead of the electromagnetic technology of the Summa-Sketch.

The tablet's input location is absolute—clicking a certain spot on the tablet will always affect the same area on the screen. You don't position the cursor by pushing and lifting the stylus over the same area, as you do with a mouse.

This property means you can place a template on the tablet and use it for immediate menu selection, rather than going through a menu hierarchy.

Priced at $495, the tablet comes with both a tip-click stylus and a four-button cursor. It plugs into a serial port and works with CADD and drawing software supporting the bit pad standard.
List Price: Bit Pad Plus, $495.
Requires: RS-232 serial port, bit pad-standard software. Summagraphics, 777 State St. Extension, Fairfield, CT 06430; (203) 384-1344.

CIRCLE 437 ON READER SERVICE CARD

The $495 electrostatic Bit Pad Plus, from Summagraphics, uses charge ratio technology to pinpoint distance doesn't change cursor position.

Two Word Processors Integrate Graphics and Link by Using Hypertext

Hypertext is the salient feature in *Black Magic*, developed by **NTERGAID**, a new firm based in Bridgeport, Connecticut. *Black Magic's* hypertext lets you link documents with notes, references, replacements, and other documents.

The $150 program can also integrate graphics with text with a screen-grabbing utility, display screen graphics fonts, use macros, and overlay windows.

NTERGAID has released public-domain programs in CGA, EGA, and Hercules graphics modes that allows others to read complete hypertext documents.

Lifetree Software, developer of *Volkswriter*, has announced *Total Word*. Lifetree says the $495 word processor brings you personal publishing with its support of Hewlett-Packard or PostScript laser printers and their fonts. The

$995 Expo Adds the Time Dimension to Your Numbers with Graph Spreadsheets

Leading Market Technologies, of Cambridge, Massachusetts, has developed *Expo*, a program that displays a spreadsheet of graphs, letting you see your data as trends over time instead of lists of numbers.

The $995 program has "Notebooks" that contain groups of related data and spreadsheet parameter files. After opening a notebook, you can add blank cells into which you can pull data or draw graphs based on formulas. Each notebook holds 64 graph cells.

Data can be imported from traditional spreadsheets, databases, or any ASCII source.

You can designate formula cells to perform arithmetic, statistical, trigonometric, and cal-

culus functions on other cells. There are macro and command file capabilities to automate operation. *Expo* functions can zoom, scroll, expand, and overlay the plots. A cross-hair cursor lets you pinpoint numbers on the charts.

There is a pipeline in *Expo* that allows you to run another program without leaving your session, and context-sensitive help is provided.
List Price: *Expo*, $995. **Requires:** 512K RAM, two disk drives, graphics adapter, DOS 3.0 or later. Not copy protected. Leading Market Technologies, One Kendall Sq., #2200, Cambridge, MA 01239; (617) 494-4747.

CIRCLE 436 ON READER SERVICE CARD

Leading Market Technologies' $995 Expo performs spreadsheet-like functions on cells containing graphs to add the time dimension to data.

Word Processors

(continued from page 51)

ability to integrate graphics also adds to this claim.

Also featured are a 300,000-word thesaurus, a 170,000-word dictionary, alternate keyboard layouts for 250 scientific and technical symbols, predefinable style sheets, and page preview.

List Price: *Black Magic*, $150. Requires: 192K RAM, two disk drives, EGA adapter, DOS 2.0 or later. Not copy protected.

NTERGAID, 955 Connecticut Ave., Bridgeport, CT 06607; (203) 368-0632.

CIRCLE 439 ON READER SERVICE CARD

List Price: *Total Word*, $495. Requires: 480K RAM, one floppy and one hard disk drive or two 3½-inch drives; DOS 2.0 or later. Not copy protected. Liferee Software Inc., 411 Pacific St., Monterey, CA 93940; (800) 543-3873; (800) 831-8733 (in Calif.).

CIRCLE 439 ON READER SERVICE CARD

The Arche Rival 386 Packs a 20-MHz PC Into Space-Saving Box

Perhaps wishing to be known as the fast-food chain of computers, or to someday have signs reading "over 10 billion sold," Arche Technologies' goldenarch logo resembles that of McDonald's, and its compatibles aim for speed.

"Fast" is the appropriate word when talking about 20-MHz machines. The Arche Rival 386 offers that speed in a

The Arche Rival 386 offers 20-MHz speed in a small-footprint system box.

6¼- by 17¾- by 16½-inch box.

Standard features include a 14-inch, 1,000-line flat-screen monitor, a high density 5¼-inch disk drive, 2MB of memory expandable to 16MB, and zero-wait-state interleaved memory, a 101-key keyboard, two parallel ports and two serial ports, eight expansion slots (two 4-bit, four 16-bit, and two 32-bit), a Hercules-compatible board, a 5¼- and 3½-inch disk controller board, and a 200-watt switchable power supply (110/220 V; 50/60 Hz).

Options include 40, 65, 80, and 140MB fixed disks and an EGA monitor.

Arche is bundling MS-DOS 3.3 and GW-BASIC with the 10/20-MHz switchable machine.

List Price: Arche Rival 386 (single-drive monochrome system), $4,395; 40MB hard disk system, $4,995; 65MB system, $5,195; 80MB system, $5,795; EGA system, $600 extra. Arche Technologies Inc., 745 High St., Westwood, MA 02090; (800) 422-4674, (617) 461-1111.

CIRCLE 440 ON READER SERVICE CARD

300-dpi CAT Scanner Attaches to Printhead Of a Dot-Matrix Printer

Computer Aided Technology makes the CAT Scanner, which snaps into an Epson- or Panasonic-standard dot matrix printer and converts what it sees into .PCX, .TIFF, or .PFF files.

The CAT Scanner has resolutions up to 300 dots per inch horizontal and 216 dpi vertical,

and 128 gray levels with software-selectable contrast. There are two scan modes: line and halftone. The former is suited to technical drawings, while the latter is best for photos.

The maximum scan area is 6 by 36 inches on a narrow-carriage printer and 12 by 36 on a wide-carriage machine.

The unidirectional scanner comes with a half-length interface board and software that lets you zoom and scale images.

List Price: CAT Scanner (with adapter card), $195. Requires: 512K RAM; one half-length bus slot; EGA, CGA, or Hercules graphics adapter; Panasonic KX-P1080, 1091, or 1092, or Epson MX, RX, FX, LX, EX, or LQ series printer; DOS 2.1 or later. Computer Aided Technology Inc., 7411 Hines Pl., #212, Dallas, TX 75235; (214) 631-6688.

CIRCLE 443 ON READER SERVICE CARD

$1,999 Minuteman Delivers 15 Minutes of 1,600VA Backup Power

Para Systems is offering a power supply unit that gives you 15 minutes of 1,600-watt backup time and protection against brownouts, surges, spikes, and EMI/RFI interference.

The $1,999 Minuteman MM1600SS/1 accepts current at 117 volts and delivers 117 V plus or minus 5 percent in a synchronized sine wave when activated by under- or overvoltage. Transfer to backup power occurs in 1 millisecond.

List Price: Minuteman MM1600SS/1, $1,999. Para Systems Inc., P.O. Box 815188, Dallas, TX 75381-5188; (800) 238-7272, (214) 446-7363.

CIRCLE 441 ON READER SERVICE CARD

3-2-1 Blastoff Uses Numeric Coprocessing to Speed Up Recalcs

Frontline Systems has produced a spreadsheet compiler and add-in that *Lotus 1-2-3* that speeds up recalculation by a factor of from 2 to 15, depending on spreadsheet complexity.

Part of the speed comes from minimal recalculation techniques, but *3-2-1 Blastoff* improves calculation efficiency by translating *1-2-3* cell formulas into machine code. The compiled spreadsheets run only inside *1-2-3* and can be altered, although changes to existing formulas will slow down performance, since the altered formula will then be interpreted by *1-2-3* rather than the compiled *3-2-1 Blastoff* worksheet.

Spreadsheets compiled with *3-2-1* also have one-half to one-third the memory requirement

of the uncompiled spreadsheet. All *1-2-3* functions are usable in the compiled version, unless you choose *3-2-1*'s secure spreadsheet option, which hides all formulas.

Compilation time is fast, too: Frontline says that compiling a spreadsheet takes only slightly longer than it takes *1-2-3* to load the same spreadsheet into memory.

List Price: *3-2-1 Blastoff*, $124.95. Requires: 384K RAM; one disk drive; 8087, 80287, or 80387 math coprocessor; *Lotus 1-2-3*, Release 2; DOS 2.0 or later. Not copy protected. Frontline Systems, P.O. Box 7408-P1, San Francisco, CA 94120; (800) 451-0303, ext. 55; (916) 677-7171.

CIRCLE 435 ON READER SERVICE CARD

The $195 CAT Scanner turns your dot matrix printer into a 300-dpi scanner.

PERSONAL ASSISTANT Extremely intelligent, excellent communication skills, easy to get along with, fast, efficient, able to carry on two conversations at once w/o errors. Must work with IBM PC and compatibles. Functions include editing, file management, transfers. Script writing a plus. Must be willing to work 24 hrs/day, 7 days/week w/o supervision. Excellent opportunities for growth. For info call (404) 441-1617.

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Dialing into Daily Weather Forecasts

HANDS ON

BY GUS VENDITTO

You may not need a weatherman to know which way the wind blows, but what about wind speed? Your radio station can give you the temperature and the chance of rain tonight, but that's not much help if you need to know about the path of an approaching storm.

Accu-Weather, a meteorological service that supplies radio and TV news with forecasts, has linked its database with a forecasting program. Metacomet Software's *Accu-Weather Forecaster* will dial the 800 number; download current statistics; plug them into map, chart, and forecast modules for

most any location; and keep archives of the reports.

Although the CGA graphics-based program is about 2 years behind the state of commercial

software (the menu-driven interface is crude but easy to use), it nicely handles the daily downloading chore with about three keystrokes, and then prepares

Accu-Weather Forecaster maps are derived from downloaded reports.

trend analysis charts for barometric pressure, wind speeds, precipitation, cloud cover, the works. It will plot a forecast for the next 48 hours for every station that you inquire of. It takes about 2 minutes to fetch one station's figures, which costs about a dollar.

If you *need* to know about the weather, *Accu-Weather Forecaster* has far greater depth than CompuServe's National Weather Service reports.

List Price: *Accu-Weather Forecaster*, $89.95 plus on-line charge of $.36, $.46, or $.56 a minute, depending on time of call. Requires: 256K RAM; CGA, EGA, or VGA; Hayes-compatible modem; DOS 2.0 or later. Metacomet Software Inc., P.O. Box 31337, Hartford, CT 06103; (203) 223-5911.

CIRCLE 448 ON READER SERVICE CARD

Reset Switch Thaws Out Frozen PCs

HANDS ON

BY EDWARD MENDELSON

When your keyboard seems frozen and not even Ctrl-Alt-Del can thaw it out, it's always better to use a reset switch than the big red power switch—if you're lucky enough to have one. IBM has never built a reset switch into its PCs, and the easiest way to add one is to buy Irata Systems' $24.95 Irata-Reset.

Irata's switch bucks the computer into thinking that the power has been turned off and on again, while actually maintaining full power to all disk drives, boards, and other equipment. This is better for your machine and your temper than the big red paddle. A reset switch doesn't produce the potentially damaging power surge that you inflict on your system when you turn the power off and on again.

Irata's switch comes in two models. The $24.95 version for true Big Blue computers, from the PC through the Model 30,

uses a tiny circuit board that plugs into the power supply connection. You need three very small hands to install it, but patience helps. Boards for most

clones are also available.

You can also build a different but equally effective switch with only a few cents' worth of parts. You'll find the method in

PC Magazine, September 16, 1986, page 340.

List Price: Irata-Reset, $24.95; clone, $11.95. Irata Sysems, 2562 E. Glade, Mesa, AZ 85204; (602) 926-7969.

CIRCLE 449 ON READER SERVICE CARD

Best Way Yet to Search PC Magazine

HANDS ON

BY JENNIFER ZAINO

In a perfect world, you wouldn't have to use the immenson "hunt and peck" method to find a particular review in your back issues of *PC Magazine*. With the arrival of *PC-NDX*, the world has become more manageable.

PC-NDX indexes the 1986 and 1987 *PC Magazine* product reviews, Productivity articles, Viewpoints, and letters. The massive databases are searched by a *Clipper*-compiled shell.

You perform searches by entering one or two keywords reflecting subject matter, author, product, and/or *PC Magazine*

category, and a browse screen with a menu listing of the matching articles appears. You call up a table of contents by entering a volume and issue number as the keyword. You use the Cursor Left and Right keys to select the year to search if both databases are installed in one subdirectory.

You move the cursor bar in the browse screen to highlight each entry. Pressing the Enter key on a highlighted entry calls up the citation screen, which provides the title of the article, its page number, a list of its keywords, and an abstract.

The program does have flaws. For instance, a search of the keyword "mouse" (for

1987) ignored at least one review in that category, while a search of some authors' names did not always reveal all the articles they had written.

For the most part, though, the searches are quick and accurate. *PC-NDX* is perfect for those who need to get their hands on a *PC Magazine* review with a minimum of fuss.

List Prices: *1986 PC-NDX*, $8; *1987 PC-NDX*, $9; *1988 PC-NDX* (to be available quarterly), $19. Requires: 256K RAM, two disk drives (hard disk recommended), DOS 2.0 or later. Not copy protected. PC-NDX, Mishawaka, IN; 46544; (219) 256-1045.

CIRCLE 450 ON READER SERVICE CARD

Introducing Paradox 386.
Optimized for 386 environments and up to 5 times faster than Paradox 2.0

It runs in the DOS environment and is a modern must for power users confronted with very large tables (tens of thousands of records or more) and/or large applications. Paradox 386 makes more ambitious mainframe-type applications feasible on the PC because it addresses up to 16 megabytes of memory.

But back to speed. Paradox processes data 32 bits at a time instead of just 16 bits at a time, so you race rather than run.

Paradox 2.0 and 386. The same but different.

Paradox 386 gives you all the functionality, power, and flexibility that earned Paradox the Software Digest top-rating for PC relational databases.* Like Paradox 2.0, the all-new Paradox 386 gives you the speed and power to:

- Query multiple tables simultaneously
- Use an unlimited number of selection criteria

Designed exclusively for 80386-based systems, Paradox* 386 runs up to 5 times faster than Paradox 2.0. It's that much faster because it accesses your full linear address space, which in English means it uses all the memory you or your company paid for when you put together your 386 systems.

With Paradox 386, the old 640K limits are a thing of the past.

*Software Digest Ratings Report, March 1986, July 1987
**Customer satisfaction is our main concern. If within 60 days of purchase this product does not perform in accordance with our claims, call our customer service department, and we will arrange a refund.

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BI 1203

- Do pattern matches and relational operations on tables with up to 2 billion records

And Paradox 386 makes fast work of big operations like:

- Retrieving data with large single or multi-table queries
- Paging through screens of information as you view large tables
- Sorting tables with several thousand records
- Developing applications with the Paradox Personal Programmer 386
- Running large memory-intensive applications

Paradox 386 also lets you share data on local area networks with workstations running different network versions of Paradox.

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BORLAND
INTERNATIONAL

Micrografx Designer: The Best PC Graphic Design Tool Around

BY GERARD KUNKEL

Just when the Macintosh is wooing aesthetically-minded PC owners with hi-res color graphics, Micrografx has taken the PC a giant step forward in design graphics with *Micrografx Designer*. This $695 vector-based drawing package brings tools usually found only on dedicated graphics workstations and Macs to the PC.

Running under the *Microsoft Windows*, Version 2.0, operating environment (a *Windows* runtime version is supplied), *Designer* provides a full toolbox of drawing aids that are really useful only with EGA or VGA graphics and only on a machine running faster than 6 MHz.

Designer does not do 3-D, is not a desktop publishing tool, and is certainly not a paint program. It can't compete with *AutoCAD* and other top-dollar CAD programs. *Designer* is the best drawing tool yet for logos, special graphics effects, and package design.

There are the conventional drawing tools, like lines, boxes,

rectangles, circles, and arcs. And there are polylines, parabolas, bezier curves, object arrays, object rotations, object mirroring, object grouping, and object connection.

The display rulers bordering the top and left side can be set to different degrees of unit measure, whether you want inches, centimeters, picas, points, or decimal inches.

Two-dimensional rotations are possible, as are linear arrays

of one or a group of objects.

Designer works in layers and uses color. This lets you create full-color images and overlays for traditional printing.

Designer supports the *Windows* fonts and some printers' fonts. However, there is no way to interactively highlight and edit text while displayed with the art. In fairness, *Designer's* use of a text-editing window for any text additions is superior to the meager support in most de-

sign programs, but *Designer* cannot wrap any text (multiple lines have to be entered one at a time), and changes to a font size make you lose your positioning edits.

Designer and its sister programs, *In*a*Vision*, *Draw*, and *Graph*, all share the .DRW file format. But you can save *Designer* files to the .PIC raster image format.

Whereas paint programs were a good introduction to computer imagery and fine for creating illustrative art, *Designer* is the first truly productive design tool for creating mechanical or technical artwork.

Micrografx Designer's clip art includes maps. The U.S. map is grouped as individual states, so sizing, moving, and color changing can be performed on any state.

Good Numbers Smooths Text File Conversions

BY PETER LOSHIN

If you've ever had to crunch numbers from a computer report, you know how galling it is to have to rekey the report. *Good Numbers*, from Creative Synergy Corp., eliminates this data entry chore, as well as the risk of entry errors.

Good Numbers converts any ASCII report file you can get onto your disk into PC-usable formats. Source files can be any ASCII file, as long as there are no records longer than 255 characters; output is to worksheet files (.WK1, .WKS, .WRK,

.WR1), ASCII comma-delimited (for database work), .DIF (column- or row-wise), or .PRN files.

You create masks that screen out unwanted rows and columns of data, use entire lines as headings, and set column titles for the columns you use.

Good Numbers does a simple job and does it quite well. It's easy to use—following the sparse manual, anyone can convert a file within minutes of installation. Using Lotus-style menus, *Good Numbers* goes further by adding features such as auto-loading if there is only one mask file in the directory and double-prompting when

you try to exit without saving.

Nice touches include data format options for currency mark translation, control character search and removal, and line-by-line viewing and verification as the program translates. The current version doesn't handle numeric character fields like ZIP codes well, since numbers are assumed to be values (Version 2.5, currently being tested, addresses this and adds other useful features).

Good Numbers will seem like manna from heaven for everyone who's struggled with the awkward data-importing functions in *1-2-3*, *dBASE*, and other applications.

Quattro: The Professional Spreadsheet, for people who'd rather switch than fight

The switch is on. People and companies are switching from 1-2-3™ to Quattro™ because they'd rather switch than fight the problems, complications, limitations, and extra expense of 1-2-3.

Spreadsheet users are seeing what they get right now with Quattro for only $199.95 and are realizing that to go the 1-2-3 route they'll find themselves paying $495 for it, then adding "Lotus Learn," "Lotus Speedup," and Lotus HAL™ ($150), which means $645.00 or nearly $450 more than Quattro. *Ouch!* to either your wallet or the company's budget. Why do it?

They're switching to Quattro because it doesn't waste time

Quattro's intelligent recalc means that it only recalculates affected cells instead of recalculating every cell the way 1-2-3 does it (unless, you've added their Speedup). Those counts too—and if you want to save yours—switch to Quattro.

There's everything to gain and nothing to lose

If you already know a lot about 1-2-3, you already know a lot about Quattro. You're not faced with learning a new program because Quattro can be made to respond to commands like 1-2-3, but with much better, faster results.

You not only bring your 1-2-3 knowledge to Quattro, you also bring your 1-2-3 files to Quattro. Quattro understands them and lets you continue to work with them—and easily produce presentation-quality results.

Switching to Quattro means you're not in a holding pattern waiting for the much-announced but never-delivered 1-2-3 Version 3.0. Quattro lets you act now.

Switching to Quattro means you avoid lengthy and complicated 1-2-3 installation procedures. Quattro senses the kind of hardware you have and installs itself automatically.

It's easy to learn and it's easy to switch

Quattro is easy to learn, whether you're just starting with your first spreadsheet or you're switching from 1-2-3. It's only $199.95 and, because it's from Borland, it has a 60-day money-back guarantee.* You'll enjoy the switch to Quattro. Why fight it?

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BORLAND

CIRCLE 377 ON READER SERVICE CARD

> "Quattro offers great control over graphs—now users don't have to go to a separate package to create business presentation graphics."
>
> Steve Owens, Price Waterhouse

> "With Lotus 1-2-3, I had to use a third-party program to annotate the graphs . . . I wasted a lot of time . . . But with Quattro, annotation and printing is integrated."
>
> Bill Todd, Siemens GammaSonics, Inc.

> "I find recalculation speed with Quattro to be more than twice as fast as with Lotus 1-2-3."
>
> Doug Cobb, President, The Cobb Group, Inc.

> "I prefer the flexible Borland menu system to the Lotus 1-2-3 menu, and I plan to change all my macros using Borland's menu system."
>
> Ron House, Western Union

> "Those who are considering purchasing 1-2-3 will be better off with Quattro."
>
> John Walkenbach, InfoWorld

PC UPDATE

VCN Concorde, Version 3.0

VCN Concorde, Version 3.0, offers many new features, including desktop publishing support through the TIFF and PostScript formats, VGA support, and full capabilities for creating business graphs, images, text, and self-running desktop videos. The new version also has enhanced text functions, more objects, and a new

VCN Concorde, Version 3.0, has full capabilities for creating business graphs and self-running desktop videos.

database. *VCN Concorde,* priced at $695, is available to registered users for $125. Visual Communications Network Inc., Cambridge, Mass.; (617) 497-4000.

PC's Limited System 300

Dell Computer Corp. has replaced its PC's Limited *386-16* AT compatible with an enhanced PC's Limited System 300. The new models, which have a base price of $4,299, add support for optional VGA monitors and 3½-inch disk drives, and incorporate the new Dell System Analyzer. In addition, Dell has announced an enhanced version of Microsoft's DOS 3.3, which features 15 utility programs exclusively for Dell customers. The new version is priced at $119.95. Dell Computer Corp., Austin, Tex.; (512) 338-4400.

The Brooklyn Bridge, Version 1.5

The Brooklyn Bridge, Version 1.5, adds five new utilities, including four DOS utilities (MOVE, REMOVE, COPY, and BACKUP) and Run, a new *Brooklyn Bridge* utility that provides for dual independent processing. *The Brooklyn Bridge* is priced at $129.95; registered users can upgrade to Version 1.5 for $10. White Crane Systems Inc., Norcross, Ga.; (404) 394-3119.

Wildcat!, Version 1.10

Mustang Software has released Version 1.10 of its *Wildcat!* bulletin board system. The new version supports additional file transfer protocols and offers a Live Program option that allows *Wildcat!* to run other applications from outside the program code. *Wildcat!,* priced at $129, is available to registered users free of charge. Mustang Software, Bakersfield, Calif.; (805) 395-0223.

Microsoft Word 4.0, Network Version, ForComment

Registered users of *Microsoft Word 4.0, Network Version,* who license a minimum of one Master Pack and three Network User Manual Packs are eligible to receive a free copy of Broderbund's *ForComment.* The network version of *ForComment,* normally priced at $995, supports up to 16 users. The network version of *Word 4.0,* which includes a coupon for *ForComment,* has a retail price of $750 for the master pack and $150 for each user pack; registered users of previous network versions can upgrade for $75 for the master pack and $40 for each user pack. Microsoft Corp., Redmond, Wash.; (206) 882-8080.

Vendex HeadStart XT, Vendex Mouse

Vendex Pacific has begun shipping a memory upgrade kit for its **HeadStart XT.** The kit, priced at $99.95, gives users an increase of RAM, from 512K to 768K. Also, Vendex is

Vendex Pacific is now offering a 256K memory upgrade kit to customers of its HeadStart XT compatible.

now bundling its new $99.95 HeadStart Mouse with Logitech's *Paint Show* graphics software at no additional charge. Vendex Pacific, Great Neck, N.Y.; (516) 482-4255.

IN BRIEF

Conographic Corp. has introduced a *Lotus 1-2-3* driver, free of charge, for its ConoVision 2800 graphics system. The driver displays 180 columns by 40 rows of a spreadsheet in a single screen. The ConoVision is priced at $1,195. Conographic Corp., Irvine, Calif.; (714) 474-1188 . . . *db/LIB,* Version 2.0, is fully compatible with Microsoft's QuickBASIC 4.0, providing two additional libraries of program development routines for use with QuickBASIC. Version 2.0, priced at $139, is available to registered users of Version 1.6 for $25. AJS Publishing, North Hollywood, Calif.; (818) 985-3383.

COMMUNIQUÉS

"Designed specifically for hard disc and critical-use business systems," reads the advertisement for this Topaz uninterruptible power supply backup unit. Must be a hard disk card tucked away inside the computer.

Microsoft Words

Just below the sealed flap of the envelope containing Microsoft MS-DOS 3.3 is the warning "Carefully read the Microsoft License Agreement inside before opening this pack!"

Amazing Facts I

"In order to initiate communications ("log on") to a BBS, you call the BBS, turn on your modem, and press a sequence of keys."
—*Computer Shopper*, February 1988

Amazing Facts II

"The [deskside] Flexarm Swing Cradle can accommodate virtually every PC or mainframe that's on the market."
—*Lyben Computer Systems* catalogue ad for system/monitor stand

Amazing Facts III

"Since IBM introduced its first PC in 1981, the original operating system from Microsoft, MS-DOS, has ruled. Short for

"data operating system," DOS is the brains of a PC."
—*Seattle Times*, January 25, 1988

Amazing Facts IV

"These difficulties (with Bankamerica's Masternet accounting system) were caused by slow run and response times, communications problems and leaky disk drives, according to a former Bankamerica employee."
—*ComputerWorld*, February 1, 1988

Amazing Facts V

"The $4895 Artisan Model 1023 handles A- to D-size drawings on cut-sheet paper and film, plotting 30 pts at an acceleration rate of two gigabytes."
—*Computer Graphics World*, February 1988

Campaign Notes '88

"At the heart of the Dole campaign's New England operation is a 16 MHz Compaq 386. The organization has added a 130 Mbyte hard disk for tape backup to complement the 4M bytes of RAM in the Compaq."
—*PC Week, February 2, 1988*

C/T

INTELLIGENT KEYBOARDS

(PC-AT/XT Compatible)

Spelling checker not included: title page of Northgate Computer Systems manual.

GENERICACME COMPUTER CO.

ORGANIZATIONAL CHART

A. Bacal

Have you heard or seen anything offbeat, unusual, or just plain dumb about the microcomputer industry? Send your offerings to Communiqués, PC Magazine, One Park Avenue, New York, NY 10016, or MCI Mail 157-9301. Please print your name legibly; include the name, city, and publication date of any newspaper or magazine clipping; and include your T-shirt size. Contributors will receive $50 and a PC Magazine T-shirt. In case of duplicate entries, the earliest postmark prevails. Sorry, but entries can't be acknowledged.

Winners this issue: John Hasselmann (Topaz/UPS), Ted Wilson (intelligent keyboards), Victor Vollman (BBS logon), William Al Muckerheide (Flexarm), Stephen Gates (data operating system), Mauro Savidelli (Masternet/leaky drives), and in re others.

Contributor Stephen Gates of Tacoma, Wash. ("MS-DOS data operating system") notes (a) "it's somewhat embarrassing to have such an error published" in Microsoft's backyard, and (b) taleofpeople were exceptionally polite to Gates when he was shopping for a computer last summer. No, no relation.

■ BILL MACHRONE

TOUGH TIMES AT THE MARKET

Things are tougher than ever for the buyers of computers for the corporation. Amid this vast richness of product offerings, they are often limited in what they can buy.

It's like starving in a supermarket. For lack of a decent shopping list, those of you with the biggest responsibility for personal computing in Corporate America face frustration. The market is changing so quickly that approval lists are going obsolete almost as quickly as they're published. At the same time, a plethora of new standards has created more uncertainty than ever before.

As a reader of *PC Magazine*, you should be familiar with the term "brand specifier," because that's what you are. A brand specifier is the knowledgeable, computer-literate individual to whom others turn when they need to know what to buy. Whether or not you have the final sign-off on spending the money, your word is law when it comes to the make and model. That, of course, is what *PC Magazine* is all about. The whole process, from First Looks to the big comparison reviews to the productivity articles to the user exchange tips, is geared to giving you the tools you need to make informed decisions on hardware and software.

Frankly, I'm worried about 1988. It's tougher to steer a smooth course this year than any other. PS/2 vs. AT bus? 286 or 386? OS/2 or DOS? Graphics or text mode? Network or standalone? Host-dependent or workgroup? And what to do with all those sorry old 8088 machines?

Even the supposedly cast-in-concrete markets are up for grabs. Lotus 1-2-3 may be the Kleenex of spreadsheets, but Lotus will have to fight aggressively to retain market share as competitors press hard with everything from lower prices to eye-popping graphics. Ashton-Tate faces a similar challenge with *dBASE IV*. Can it keep the likes of *Oracle* and *Informix* at bay, much less *Paradox*? We'll see.

DOWN THE AISLES Let's take a row-by-row tour of this supermarket. We'll do a little comparison shopping along the way and speculate on these issues.

First, that granddaddy of all debates, PS/2 vs. AT architecture. We've been talking about it for a year now, heard all the comparisons to New Coke and Coke Classic. For today's applications, however, it doesn't make a whole lot of difference. A dearth of PS/2 add-in boards has held back acceptance of the Micro Channel, and you still can't get everything you want in connectivity products. Otherwise, the choice comes down to whether you're ready to integrate 3½-inch disks into your work environment. I hate to oversimplify, but that's about it. No one will be ready to

do anything significant with the multiprocessor features of the Micro Channel for another year or so, and the VGA is obviously the way to go for both buses, despite the inadequacy (too small, too fuzzy) of IBM's monitors. Watch the freshness dating on the package: insist on register-level compatibility for your VGA boards.

The 286 vs. 386 issue remains hot, with no relief in sight. Due to AMD's inability to make fast, cheap 80286 chips, the low-cost 16- and 20-MHz 286 machines failed to materialize. Thus, the price differential between 286 and 386 machines remains at $1,500 to $2,000. The 386 retains its performance edge, and the systems software types are giving you better reasons daily for using a 386. Between *DESQview*, *Microsoft Windows/386*, VM/386, UNIX, and PC-MOS, there's something for everybody. Lest we forget, a 386 gives OS/2 a nice performance boost, too.

Speaking of which, Bill Lowe has stated that the company expects to see 2,000 programs running under OS/2 by the end of 1988. Given that it started from zero, that's quite ambitious. We believe in OS/2 enough to convert 30 or 40 of *PC Magazine*'s utility programs, but that leaves 1,960 to go. The extent to which Lowe is right is the extent to which OS/2 succeeds. The applications are the critical path to its success. Obviously, no one will convert all their users en masse to OS/2. The expense is too great, the benefits are too small, and the compatibility box isn't compatible enough. Although we'll see slow and steady progress through the year, 1989 will be the big one for OS/2.

VIEWPOINTS

■ BILL MACHRONE

Meanwhile, the majority of software publishers are holding out for Presentation Manager. They're right in waiting. PM is the best shot we have at a standard user interface, and most machines sold today are PM-capable. I'm all for it. Corporate America will save millions on training alone. But PM applications won't hit big until late 1989. In the meantime, make

■ **Frankly, I'm worried about 1988. It's tougher to steer a smooth course this year than any other.**

sure your hardware is ready for PM (286 or 386, EGA or VGA), and buy whatever applications you need to see you through. As we cruise down the video aisle, it's clear that 640 by 480 is the way to go—this year. Pass by the offerings of more than 16 colors for now. Look for more resolution and larger screens. IBM's 8514 is stunning, albeit a little shy on contrast, but you can get it only in PS/2 form.

Meanwhile, what do you do with those dead lobsters at the bottom of the tank, the 8088-based machines? You can't palm them off on secretaries. They need real power, too. State-of-the-art word processing requires a hard disk. It benefits dramatically from a graphics screen and a fast processor for the spelling checker. Best bet: If you just want to run DOS faster, any of the inexpensive accelerator boards will do the job, such as PCSG's Breakthrough board. In order to leave the door open for OS/2, you need something special, like SOTA's MotherCard 5.0. The 386 boards for the PC will be interesting once they can run all the important programs, such as Windows/386, OS/2, DESQview 386, and VM/386. Until then, the 286 cards are a cheaper solution.

You've got to do more than muddle through 1988; you've got to come up with some strong recommendations, ones that set the stage for all the hardware and software goodies to come.

See you at the checkout counter. ⚑

■ JOHN C. DVORAK

THE FUTURE IS PAST

Looking back at a fast-moving industry trend that literally changed the world reveals the time when Dvorak actually came close to being wrong in print.

I like to talk about history in this column. I've always felt that to understand this business one must understand the industry's past. Recently I plowed through some old computer magazines and noticed that I've always overlooked one thing in my historical pursuit. I've discovered that I always look at what happened in the past from one dimension: I tend to look at the trends that were successful. I usually compare them to false trends or dead ends. What I ignored were genuine and positive trends that simply died for one reason or another. We can assume that this tendency for a successful trend to simply drop dead still exists.

The most notable trend in 1980 was the continuation of the 8-bit microprocessor as the king of the hill. When the IBM PC with the 8088 came along one year later, most pundits and observers felt that it was interesting, but hardly a candidate for a takeover of the business. Most observers saw it as nothing more than an aberration. An oddball system. The most popular add-in card for it was a "Baby Blue" Z-80 card designed so the PC could run old CP/M software.

As the IBM PC began to grow in popularity, rationalization loomed for the 8-bit world. David Crellan, in his article titled "Don't Count Out the 8-bit Micro" (*Computer Dealer*, September 1982), poohpoohed the notion that the 16-bit computer meant anything to the marketplace. He cited the long lead time from the introduction of the 16-bit microprocessor by the chip makers to the development of new systems as a signal that they wouldn't be popular. People weren't interested. People wanted highly compatible CP/M systems. Right. And Americans would never eat raw fish.

PC MOANS AND GROANS Badmouthing the PC permeated the scene back in 1981. I had a newsletter at the time that supported a now-passé 8-bit system, and I accompanied a vendor friend (a maker of a popular Z-80-based system) when he bought an early IBM PC to analyze. We tore it apart, and he moaned and groaned about how the cards were too long and too thick and too expensive and poorly designed. Moan, moan, moan. He concluded it was a disaster. I wrote up a negative review of the PC and, with qualms, inserted it in the newsletter I was composing at

the time. It was too bad the PC was a dog, I thought to myself. That same day, I became uncomfortable with the review and continued to research the new world of the PC. That's when I ran into another friend—a techie who worked at ComputerLand. He raved about the machine. He was especially impressed with IBM's "professional" attitude compared with the "arrogant guys from Apple." He convinced me that the PC would be hot.

I went to the printer and with scissors excised the critical review, leaving a peculiar hole in the document. This was no time to be hasty, I figured. Something was up. In no time, the world turned upside down and the 8-bit makers were dead meat. It was pathetic how they refused to bail out of an airplane headed straight down. Worse, some big names brought out new 8-bit machines later after the writing was on the wall.

But was the writing on the wall? Or were Datapro and the other research companies painting a rosy picture only too happily read by those vested in the old world of the Z-80? "There's a software base," they all said. "People buy solutions, not computers," they all said. "Z-80s are better than 8088s," they all said. But the people who counted weren't listening to what they all said. The people who count still don't listen to what "they all say." They listen to each other and nobody else. If they go astray, it's not for long. And when the movers and shakers bail out, they waste little time. *That's* the lesson we learned from the collapse of the 8-bit world.

Illustration: Mark Matcho

■ JOHN C. DVORAK

INSIDE TRACK

PC vendors look for alternatives; the Mac threatens the PC on its own turf; rumors abound; theories teem.

The scenario worsens with every passing day. The newfound popularity of the Macintosh computer has the PC-compatible makers—and even IBM itself—worried that loyal users will break rank and change environments. Now we hear rumors that **Tandy Corp.** is working on a **secret Mac clone** it hopes to announce by year end. **Sony** is another name that keeps cropping up as a potential supplier of a Mac clone. Apple lawyers aren't too pleased about these potential defendants. IBM isn't too pleased about fighting a second front.

Meanwhile, the Taiwanese and the Koreans have prepared cases and are **ready to roll Mac look-alikes** when someone shows them how to do the software.

This may come sooner than expected. On the West Coast, a tight-lipped **cadre of software hotshots** have supposedly developed Macintosh-emulation software that will be the core of any or all Mac clones and will be used as a base add-on for next-generation machines to be shown by NeXT and Sun Microsystems. (The only product yet marketed to make a quasi-Mac clone has been a thing called the Magic Sack. It turns an Atari 68000-based computer into a Mac clone. It's a pure hobbyist's product that requires the buyer to **scrounge** or copy a set of Mac ROMs. No known attempt has been made to reverse-engineer the Mac to date.)

The most amusing newcomer to the PC scene may be **Sun Microsystems** and its upcoming new entry to the personal computer scene—jokingly referred to as the **SPARCintosh**. Sun, a premier manufacturer of high-end personal workstations running UNIX and an even now-windowing software, has recently developed

a RISC chip called the SPARC. For **some unknown reason** (mostly ego gratification, perhaps) the company feels it can go toe-to-toe in the low end with what one insider calls "a response to the Macintosh II." The Mac II is a machine the company perceives as some sort of threat to its line of VME bus machines. Sun thinks it will blow into the market and show the bigger players how to do it right. DEC once figured it could blow away IBM in the PC business too.

Here's the joke of it—a humorous story floating around the industry: Sun likes to brag about its RISC chip by saying that it is the first computer company to design a processor chip that it will not keep proprietary. Sun wants everyone to buy it. Sun wants everyone to license it. Sun wants it to become a standard. Until now, only semiconductor makers have sold CPUs to everyone. According to the Sun litany, **semiconductor guys can never really get it right** because they aren't computer people. Sun sings praises to itself about its "open" approach to the market.

So what happens? Supposedly **wunderkind** Michael Dell (of PC's Limited a.k.a. Dell Computing fame) expresses an interest in the SPARC chip for some reason (gosh, let me try to guess what *he* might do with it—jewelry perhaps?) and asks Sun for more information. Meanwhile, Sun plans to use the chip for its SPARCintosh. It soon dawns on somebody that if someone like Dell got hold of the thing, he might **make a cheaper machine** than Sun will make. After all, Sun is used to those big minicomputer margins. *Red alert!* **Panic sets in** and meetings are held. What to do? What to do? Last I heard, Sun was flying some hon-chos to Austin to try to put together a

joint venture of some sort with Dell to keep him from lowballing Sun with a PC cum Sun cum Mac do-all computer. As far as I can tell, it's all because the guy asked for a spec sheet. So much for idealism from the company promoting open architecture. I suspect that Sun will rethink all its **malarkey** and keep the next iteration of the SPARC to itself.

In the meantime, **IBM** wonders why nobody cares about it anymore. Suddenly (or not so suddenly) its machines and its users **are now perceived as boring.** As more mainframers (whose only concern is a better micro-to-mainframe link) move into the scene flashing a **fat bankroll**, they push aside the masses of small users who made Bill Gates a billionaire. The results of this shift are apparent at the trade shows. There is virtually no enthusiast-oriented PC show left. The only successful PC specialty show is PC Expo, a show mostly for **dreary volume buyers** looking for a good deal on a site license. The Macintosh crowd, in contrast, has two huge specialty shows that pack them in and impress everyone. Not good for the future of the PC.

To compound the problem, we now begin to see products like XDOS from Hunter Systems. It's a cross compiler **that takes executable code from the MS-DOS world and turns it into 68020** code ready to run under a 68020 UNIX. According to our West Coast editor, you can take *Lotus 1-2-3*, grind it through this program and have *Lotus 1-2-3* running under UNIX on a Sun. I don't believe it for a minute, but I'm willing to be convinced. It's stuff like this that makes things interesting during times of transition. According to sources, the new compiled code **runs as fast** on the 68020 as it does on an 80386! This is an ominous claim. Think of the possibilities!

Here's the challenge: let's see if we can get *WordStar* to run on one of those 68020 UNIX workstations. Talk about a **giant step for mankind.** ▨

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■ JIM SEYMOUR

A SPREADSHEET TAXONOMY, PART 2

In the second part of this series, Seymour looks at the Big Four new spreadsheet programs and offers his thoughts on how they'll be positioned in the marketplace.

When it rains, it pours. After a couple of years during which we saw few good new approaches to how spreadsheets ought to work, we now have four major new entries in the PC spreadsheet derby.

With *Lotus 1-2-3*, Release 3, due in late spring or summer, that's five. Count *1-2-3/G*, the OS/2 Presentation Manager-based product that's due this fall, and that makes *six*.

The Big Four include Microsoft's *Excel*, PCSG's *Lucid 3D*, Borland's *Quattro*, and Surpass's *Surpass*.

PEGGING THE PROGRAMS

Last time, I offered two tests for those considering switching spreadsheets. And I said I'd pass along a "spreadsheet taxonomy" I've worked out with corporate clients that can help them screen the new programs and get a handle on which kinds of spreadsheet users are likely to find each of these new programs a good fit.

One of the programs is easy to peg: *Surpass*. It's for the *1-2-3* purist, the user who damns Lotus for its slowness in improving *1-2-3*.

Surpass is in many ways what Lotus *1-2-3* might have been in Release 2.0. With multiple spreadsheets open on-screen at once, good use of the EGA's 43-line mode, intelligent recalculation, and a command set that's a superset of *1-2-3*'s slash-this and slash-that, *Surpass* is exactly right for the *1-2-3* user who's hit the wall and wants not a new paradigm or a new approach, but just more "*1-2-3*-ness."

PCSG's $99 *Lucid 3D* is a bit harder to peg. I've been calling it an "Everyman's Spreadsheet," and I think that's how the market will position it. It's much more than an inexpensive alternative to *1-2-3*.

While the idea of a pop-up spreadsheet at first suggests a less-than-serious product, it's impossible to work with *Lucid 3D* and not respect the ideas behind it.

Lucid 3D makes it easy to link spreadsheets, which don't have to be in memory. Building more but smaller worksheets, then linking them into a roll-up sheet, is almost always a better answer than building the kind of huge, unwieldy, debug-resistant spreadsheets *1-2-3* has encouraged.

Lucid 3D is filled with nice touches. One of the best is its screen-capture routine, which allows you to snatch a block of dead, lifeless numbers out of, say, a word-processing document, and slap 'em into a *Lucid 3D* worksheet about as fast as you can read this paragraph. You can go both ways, copying to its clipboard a patch of your spreadsheet as ASCII text, then pasting that into an underlying document. (Beginning to see why a pop-up spreadsheet makes sense?)

Lucid's not for the power spreadsheet user who carves a notch in his PC every time he fills up his expanded memory card's RAM with a /File Combine spectacular. But it's a sensational product for a lot of people in business—most of them, I suspect, not using spreadsheet software.

BIGGER THAN BIG

That leaves us with the two biggest programs of the Big Four—and the two hardest to figure: *Excel* and *Quattro*.

Microsoft Excel is a great product. Sure, it eats up real estate on your hard disk. And demands a ton of RAM. And looks like hell unless you have an EGA or better display. And it really wants to find a 386 chip in your PC.

But it also gives you a great deal in return. And once you cross the threshold of all that computer power, it's no slug. In head-to-head tests on the same hardware (286 and 386 PCs) I've found it to be almost always as fast or slightly faster than *1-2-3*, even when I use Lotus's nifty new giveaway add-in, *Speedup*, to make *1-2-3* recalcs a little smarter.

Excel is for the open-minded PC user, someone willing to invest the time needed to learn a new program—but with very high expectations for the return on that investment. More than any other PC software since *1-2-3* appeared, *Excel* rewards that kind of open-mindedness and fulfills those expectations.

■ JIM SEYMOUR

Which leaves *Quattro*.

Part of *Quattro's* natural market is self-evident: price-sensitive buyers and companies. Typically selling for a third as much as *1-2-3*, *Excel* or *Surpass*, *Quattro* is appealing to those who have to proliferate software further in their companies—on fewer dollars.

I like *Quattro* a lot. In some cases it's even faster than *1-2-3*—though not as often as suggested in its ads. Borland emphasizes areas where *Quattro* is much faster than *1-2-3* (such as navigating around a spreadsheet, and recalcs involving exponentiation), while ignoring such operations as addition, multiplication, and division, at which it's often slower.

And I've found *Quattro* less *1-2-3*-compatible than claimed. Others, including our West Coast editor and spreadsheet guru, Jared Taylor, have also found *1-2-3* worksheets that bring *Quattro* to its knees.

■ *Surpass* **is exactly right for the** *1-2-3* **user who's hit the wall and wants not a new paradigm or a new approach, but just more** *"1-2-3-ness."*

Philippe Kahn's marketing genius and the resources Borland can bring to selling *Quattro* certainly mean that it's not going to go away, and a street price just over $100 also augurs for a long life. My educated guess is that *Quattro* will, over time, be tagged as the low-cost spread: good if not great, an amazing bargain, a product that scared Lotus and gave *1-2-3* its comeuppance . . . but which never dominates the market.

I see *Quattro* not as a replacement for *1-2-3* in many companies—a role *Surpass* and *Excel* clearly can handle—but as a way to extend the spreadsheet function to additional workstations, especially if the people driving those PCs aren't likely to become heavy-duty spreadsheeters.

But remember: we still have the ghosts of Lotus's new *1-2-3* R. 3 and *1-2-3/G* hovering over the market. Unfair as it is to stack vaporware up against shrink-wrapped reality, that's what current *1-2-3* users are doing.

Next time we'll look at the Lotus gambit, and I'll wrap up my notes on how you can determine which of these programs is right for you.

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■ STEPHEN MANES

HOW TIME FLIES: STEVE'S SILVER ANNIVERSARY

He was present at the birth of the personal computer. He's in a nostalgic mood. Of course, he would never think of blowing his own horn, but . . . .

This is the gala 25th anniversary of the Viewpoints: Stephen Manes column. It was Epicurus or maybe Epictetus—I had bad flashbacks and had to miss class that month, as I recall—who uttered those immortal words, "Time sure flies when you're having fun." And I wouldn't give up a single one of ticks of the old clock chip since then. It's been groovier than *Flight Simulator*.

I've taken pains to avoid recalling the details more than half a dozen times each year, so many of you may be unaware that I was present at the birth of the personal computer. It actually came about *after* I coined the catchy term PEDPAC (Personal Electronic Data Processing And Calculating) that's become such an integral part of our vernacular. Back then, narrow-minded souls snickered at the vision that led me to refer to house-sized behemoths as PED-PACs for more than a decade; the designers of the first true personal computer, the Sirius, recognized my talent and hired me as chief of documentation.

But in that six-man company I did a lot more than just write manuals. For example, it was I who recommended our original LED-and-toggle-switch user interface. I firmly believed (and still do) that keyboard-and-monitor interfaces often lead users to think they know how to use their machines without ever having read the documentation. Believe me, nobody started messing with that original Sirius without some pretty intensive book-learning.

Still, Dogstar Computing went belly up. Convinced nonetheless that these little dynamos were the wave of the future, I founded *PEDPAC* magazine, the fledgling industry's independent voice. Things were so hectic back then, I often seemed to be in six places at once—though I suppose that might have been the flashbacks past.

CREATIVE SPARK My famous checkered flannel shirt gave Dan Bricklin the original idea for VisiCalc. A gravy spot on one of my signature bow ties gave Wayne Ratliff the spark for his beloved *dBASE* "dot prompt." And Seymour Rubinstein and Rob Barnaby were inspired to create *WordStar* when they overheard me discipline my atonal little pet, Karlheinz Doghausen—"Control, K.D.!"

Then IBM changed the PEDPAC world overnight. In a move that some of my associates called "as gutsy as the attack on Iwo Jima," I started *PEDPAC IBM* magazine. Many have since offered many reasons for its unfortunate demise, but personally I think it was our hard-hitting no-compro-

mises editorial stance. Tough, honest articles like "Forget Floppy Disks: Cassettes Work Just Fine," my oft-quoted editorial "Do We Really Need Another VisiCalc Clone? Down for the Count, *1-2-3*," and our centerfold of influential p-System users alienated potential advertisers.

Still, independence has always been my watchword. A child of the sixties, I twice demonstrated against air pollution and, in sympathy with the Native American protesters, developed a wounded knee. When I brought my activism to these pages, my lonely stand against copy protection single-handedly eliminated this scurrilous practice; my attack on illegal copying wiped out software piracy in one fell swoop; and my scathing denunciation of vaporware made it vanish into the ether.

SPITTING PROHIBITED Perhaps my finest moment came when I took on the authoritarian town of Tacochip, Texas, whose ordinance against expectorating on the public bus clearly violated the spirit of freedom we Americans cherish. I forthrightly stated that until the law was changed I would never set foot in the burg, and I urged that no computer organization even consider convening in the new 250-seat high school Cafetorium, the "Eighth Wonder of the Northwest Panhandle."

Some readers claimed that piece had no place in this magazine, but the tens of letters, dripping with the indignation of expectoration rights advocates, clearly demonstrated my correctness. Though I am sorry to report that the ordinance remains on the books, I am proud that our industry

■ STEPHEN MANES

strongly resisted the blandishments of the Chamber of Commerce: no computer confabs have been held in Tacoship since I revealed its perfidy.

More recently, I fearlessly revealed that our own PC Labs tests cannot be as impartial as we claim because of the shocking truth that every single PC Labs member has *prior computer experience* and some actually have been seen *talking with hardware and software manufacturers*. Unfortunately, the editors rejected my suggestion that we eliminate all possibility of bias by contracting the work to an outside firm that has tested nothing but high-tech refrigerator magnets for the past 3.7 years. However, I'm delighted to report that one of our competitors has done just that.

PERSONAL ACHIEVEMENT As one who was present at the birth of the personal computer, I considered awarding quarter-century Manes Personal Achievement Medals here, much as I do annually to flatter industry bigwigs. But then I realized I'd have to leave out some deserving recipients in order to have enough space to recall my own personal achievements. So to those who've been almost as influential as I over the years, let me just say we all know who you are, gang, and nice work.

I had hoped the management might celebrate this festive occasion and perhaps help our subscription renewal rate by featuring a special wraparound gatefold cover with the logo "The Most Intelligent and Charming People in the Universe" and tiny pictures of all my loyal readers. However, our art director said it would be a real shame to waste so much white space.

But I do think it's important to note the caliber of attention this anniversary of mine has attracted. My electronic in-box is overflowing with congratulatory messages. Many are perhaps a bit too ribald for these pages, but let me assure you that a list of their senders would read like a Who's Who of the industry. Let me quote just one example from a fellow pioneer:

"Twenty-five years already? Seems like cons."

—Charles "Chuck" Babbage

What of the next quarter-century? I predict that as computer use grows and our readership soars, I will become more popular and influential than Russell Baker, Art Buchwald, and Heloise put together. By the end of the century, I'll be ranked up there with Jonathan Swift and Edgar Guest. And I'll be using a supercomputer or at least a big network, because these lousy PEDPACs—uh, sorry, personal computers—just won't cut it anymore. As I may have mentioned, I was present at the birth of the personal computer; I plan to be there for the funeral.

IBM'S
PS/2
MODEL
80-111:

Go ahead. Stare through your monitor screen into the world of daydreams. Let your eyes glaze over with thoughts of harmony and perfection. What are you thinking of? If you're like the rest of us computer drudges, you're wrapping your fingers around the ultimate PC: the cost-is-no-object, byte-bashing, fire-breathing, super-performance miracle machine of your fondest dreams.

Odds are your recipe runs something like this: take Intel Corp.'s most powerful microprocessor, the 80386, run it at its 20-MHz maximum rated speed, couple it to a big, high-speed hard disk using an ESDI (Enhanced Small Device Interface) controller, and build it using the latest surface-mount circuitry and IBM's new Micro Channel architecture. Finally, pull out the icing gun and squirt the most important frosting on this exotic cake: I-B-M, the three letters that guarantee compatibility, your peace of mind, and your job.

With its renowned marketing savvy, IBM apparently tapped into our daydreams and came up with the Personal System/2 Model 80-111. This latest IBM electronic wonder doesn't just incorporate

A Dream Deferred

all the features that fill your reveries, it also boasts of being the fastest, most powerful personal computer ever made by the largest computer manufacturer in the world. For $10,995 you probably wouldn't expect less.

In fact, you'd probably expect more, but as it stands, the Model 80-111 is 25 percent faster than its predecessor, the 16-MHz Model 80-071, upgraded with a 115MB hard disk. If your time is important, that 25 percent can be valuable indeed. But if your time is really in demand—and your mind is open to things that don't come in shades of blue—you'll

It's the most powerful PS/2 machine yet, but testing shows that the 20-MHz, 80386-based PS/2 Model 80-111 system is less than the sum of its parts.

find greater speed and power elsewhere. What you get with the Model 80-111 instead is a very competent computer: the fastest PS/2 on the market today.

JUST ANOTHER PRETTY CASE Examine the inside of the Model 80-111, and you'll find no breakthroughs. The machine is merely a mélange of components pulled off the shelf from the IBM Personal System/2 design school with a new system board bolted in.

The one part of the Model 80-111 that sets it apart from its PS/2 peers is screwed to the right side of its case-cum-chassis—its planar (system) board. It looks almost insignificant: just 10½ by 15 inches of green glass-epoxy layered with surface-mount components and big, square, dedicated VLSI circuits. To accommodate its higher speed requirements, the 20-MHz planar board has been substantially revised from the 16-MHz planar.

Hidden under the hard disk rack beneath the area where the D: drive would be mounted is an Intel 80386-20 microprocessor and a socket reserved for an 80387 numeric coprocessor. Both chips run at the full 20 MHz.

Just above the hard disk rack are two sockets for plugging in small memory boards. Only video memory is resident on

The IBM PS/2 80-111 (pictured here with the $1,550 14-inch Model 8514 VGA monitor) comes standard with 2MB RAM, a 1.44MB 3½-inch floppy disk drive, and a 115MB ESDI-controlled hard disk. In benchmark testing, the hard disk reported an access time of 32.7 milliseconds, not fast enough to keep up with the Compaq Deskpro 386/20's 16-millisecond drive.

the Model 80-111 planar.

Standard equipment fills one with a proprietary daughtercard that holds 2MB of dynamic RAM in 24 of IBM's own 80-nanosecond chips (yes, that works out to about 750 kilobits per chip, with 1 bit per byte reserved for parity checking). More memory can be added either in the second socket or via expansion boards.

Unlike the 16-MHz Model 80-071, which uses ordinary flat memory, the Model 80-111 RAM is operated in page mode with a page size of 2K. This architecture allows repeated memory reads within a given page to be made without wait states. Memory writes within a page require one wait state. Reads or writes out-

side of the current page impose two wait states.

While the memory-cycle time of the Model 80-071 always amounted to 187 nanoseconds, that of the Model 80-111 varied between 100 nanoseconds (reading within the current page) to 200 nanoseconds (accessing outside the current page). According to IBM, the net result obtained by this architecture is 0.8 wait states, the same figure claimed by Compaq for the original 16-MHz Deskpro 386, which uses a similar memory configuration.

PC Labs memory tests do not favor this architecture because they involve moving large blocks of data between memory areas larger than a page. As a result, in

benchmark testing, both the conventional and extended memory areas of the Model 80-111 yielded roughly the same performance as the 16-MHz Model 80-071.

The Micro Channel bus of the Model 80-111, operating at 10 MHz (one-half the clock speed of the microprocessor), extends through the system's eight expansion slots. Three of these slots are equipped with a bus width of 32 bits, while the balance have 16-bit bus widths, with one of the latter boasting an extended connector to accommodate video expansion. As standard equipment, only one 16-bit slot is filled with the ESDI hard disk controller. The controller is capable of operating a second ESDI hard disk.

The standard equipment hard disk, located in the rear half of this internal bay, is an IBM-made 115MB (formatted) unit that's equipped with a 10-MHz data-transfer-rate ESDI interface. In testing, the drive yielded a 32.7-millisecond average access time.

IBM further enhances hard disk performance by logically simulating 64 heads (instead of the 8 physical heads) and applying caching software (in the form of hidden files on the Reference Diskette included with the system) as standard equipment.

In operation, the hard disk subsystem is commendably quick and responsive—faster than anything else in the IBM PC product line. But compared with the competition, the powerful IBM combination seems somehow anemic.

Compaq's choice for its top-of-the-line Deskpro 386/20—a 16-millisecond average access time drive, caching software, ESDI interface, and innovative bus engineering ("The Fastest Ride Around," *PC Magazine*, January 26, 1988)—earns the machine a substantial performance lead over the Model 80-111 no matter how you measure it. Even in pure sequential file building through DOS, an area in which the Micro Channel should prove its mettle, the Deskpro was more than 30 percent faster (345 versus 250 kilobytes per second, respectively).

SYSTEM BOARD CIRCUITRY Built into the system board circuitry are several standard features. Besides the parallel and serial I/O ports (as with all PS/2s, the Mod-

el 80-111 parallel port does operate bidirectionally), included on the system board are the floppy disk controller, VGA video, clock, and CMOS Programmable Option Select (POS) memory.

Because of the POS feature, the Model 80-111 system board requires no jumpers, no DIP switches, no mess, no bother. Instead, you run a system setup program on a copy of the Reference Diskette to configure not only the disk drives but also the options that are installed in the expansion slots. Overall, POS rates as a smart/dumb

■ The Model 80's hard disk subsystem is commendably quick and responsive. But compared with the competition, it seems somehow anemic.

system—smart enough to know when you've changed something, but so dumb that you've got to go through the setup with every alteration you make. A smarter design would have been to have the system automatically configure itself to whatever changes it detected, warn you of any of the detected changes, and give you a chance for customization—all without obstinately enforcing the setup process.

Because VGA circuitry is built into the Model 80-111, all you need to do to have a functional system is add a monitor. As with all models of PS/2 beyond the Model 50, the Model 80-111 accommodates either a monochrome or color display. You'll need either an official IBM PS/2 display or a multiple-scanning monitor with analog inputs that can handle the 31-kHz horizontal sync frequency of the VGA standard, like the NEC MultiSync II or the Sony Multiscan monitor. Software compatibility should not be a worry because the VGA adapter has full backward compatibility with all previous IBM standards (but not Hercules graphics).

Any evaluation of the performance of

the Model 80-111 video system depends on your standard of comparison. Compared with AT clones, even those based on the 80386 microprocessor, the Model 80-111 is quick—much faster in rewriting the screen than are EGA adapters. Compared with Compaq's 16-bit VGA adapter, however, the Model 80-111 is a slug. Compaq's direct screen writes are nearly four times as quick when the VGA adapter is installed on a Deskpro 386/20. Indeed, the mechanical differences between the Model 80-111, the slower Model 80s, and even the $5,000 cheaper Model 60 are insignificant.

As with the other two stand-up PS/2s, the Model 80-111 is not a desktop computer but rather a deskside companion. Its case is identical to the 80286-based Model 60's and to the slower 80386-based Model 80-071's, standing 24 inches high, 7 inches wide, and 19 inches deep. At the bottom of the system are two small flipper-like feet that rotate 90 degrees and lock in place to extend the width of the base of the case to a full foot, eliminating the teeter from the tower.

Construction can be described as a molded reinforced plastic monocoque, with the plastic bearing full structural stress and providing support for all inner assemblies. The inside is lined with a silver-based conductive paint that traps interference within and earns the Model 80-111 the same FCC Class B rating (suitable for home use) as the rest of the PS/2 line. The external finish is spray-painted the pale white-beige shade that all office equipment has devolved to. Underneath that is a gray primer and plastic roughly the color of the top paint. While the topcoat color ensures consistent hues across different batches of plastic, the primer will make any scuffs, scratches, or abrasions readily apparent.

On the top of the case is a fold-down, full-length painted metal handle. Roughly rectangular in cross section, it is large enough to give a tolerable grip. The 40-pound-plus weight of the machine marks it as a severe arm-stretcher, about as luggable as a small refrigerator. The Model 80-111 makes no pretense of being portable, however. The handle is designed solely to help tote the little barge between offices or departments.

REAR WINDOWS The back end of the Model 80-111 is all business and cables. The power cable plugs into a jack at the top and hangs down nearly the full height of the case. No jack is provided for switched monitor power. At bottom are the eight silver faces of the expansion-slot-retaining brackets, stacked like aluminum venetian blinds.

In between are the vital input and output jacks that are directly connected to the system board. From top down, the list reads: keyboard, mouse, parallel, serial, and video ports.

While the keyboard and mouse ports are identical and use the new PS/2-style connector (making them incompatible with ordinary PC and AT accessories), the parallel and serial ports follow the original PC standard female and male (respectively) DB-25 standard. The video connector is the female DB-15 used by the Video Graphics Array (VGA) system.

The front of the Model 80-111 puts the system's only nonkeyboard control, the power switch, at your fingertips in the guise of a big orange paddle near the top of the monolith. Next to it are a power-good indicator (once known as the ''pilot light'') and hard disk activity indicator.

Below is a vertical stack of two 3½-inch drive bays. As standard equipment, one comes filled with a 1.44MB floppy disk drive. The other is prewired for a second similar unit or, perhaps, a third-party tape backup system.

Farther down is a blank insert that hides a full-height, 5¼-inch drive bay. This bay has potential front panel access, making it suitable for an optical disk, cartridge hard disk, DC600-style tape backup system, or second hard disk.

The entire physical arrangement is very handy, putting the disk slots at your fingertips. Sitting next to your work surface, the machine itself makes an excellent place to put your coffee cup when the desktop debris becomes too dense.

INNER SELF Access to the inner works of the Model 80-111 is accomplished by removing the left side of the chassis, which is secured by two large capture screws. Any coin of two bits or less fits this.

To prevent internal components from migrating to other systems via persons un-

Benchmark Tests: IBM PS/2 Model 80-111

The obvious comparison to make in the benchmark-test results is between Compaq's Deskpro 386/20 and the IBM PS/2 Model 80-111. An assist from Intel's 82385 memory cache controller makes the Deskpro's classic PC bus outperform the PS/2's Micro Channel architecture when it comes to the Conventional Memory test, and the 386/20's 70MB hard disk outperforms the Model 80-111's big 115MB ESDI-controlled disk by nearly 2 to 1. Perhaps most startling of all, the new 16-bit Compaq VGA adapter's performance simply blows the IBM version off the charts.

The NOP benchmark test is designed to measure raw clock speed and memory access time while minimizing differences in microprocessors and the effect of memory caching. This test executes almost nothing but NOP ("No Operation") machine code instructions in a big 128K loop.

The 80386 Instruction Mix benchmark test measures the time it takes to execute a selected series of processor-intensive tasks. The test program uses 80386 instruction code. These instructions are a subset of the total processor instruction set. The 80386 Instruction Mix implements a number of 32-bit operations. In the 80386 processor these become single instructions, whereas in the 8086 and 80286 versions of the benchmark test they remain multiple instructions.

The Floating-Point Calculation benchmark test measures processor speed by looping through a series of floating-point calculations, including multiplication, division, exponentiation, and logarithmic and trigonometric functions. The benchmark program uses the floating-point library included with Microsoft C Compiler 4.0.

The Conventional Memory benchmark test allocates 256K of conventional memory and treats it as a series of 64-byte records. Then, 16,384 random records are read into and written from the memory. The result shown is the average of the read and write times.

The DOS Disk Access benchmark test measures the time it takes to do a random sector read using DOS. DOS buffers are set at 3 and the interleave factor is set at the drive's default setting. This test adds DOS's overhead to the BIOS and hardware times. The test program performs the sector read 1,000 times within the DOS disk partition. The average result is shown in milliseconds.
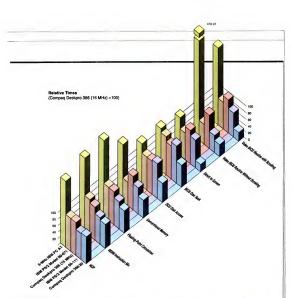
The BIOS Disk Seek benchmark test measures the time it takes to do a random seek using the disk's ROM BIOS. The test result includes minimal software overhead and may not parallel the manufacturer's claimed average access time. The test program performs 1,000 seeks. The average result is shown in milliseconds.

The Direct to Screen benchmark test measures the bandwidth of the video adapter by writing directly to the display memory buffer. The test is performed in video mode 3. The entire screen is updated using the assembly language REP STOSW instruction with register CS equal to 2000. This is done 1,000 times, and the result shown is the total of the 1,000 trials.
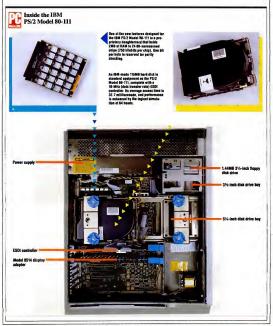
The Video BIOS Routine Without Scrolling benchmark test measures the speed of the BIOS Teletype routine without scrolling. The test is performed in video mode 3. The screen is cleared and 24 lines of 60 characters each (including a terminating carriage return and line feed) are written to the display through the BIOS Teletype routine. This is done ten times, and the result shown is the total of the ten trials.

The Video BIOS Routine with Scrolling benchmark test measures the speed of the BIOS Teletype routine with scrolling. The test is performed in video mode 3. The screen is cleared and 240 lines of 60 characters each (including a terminating carriage return and line feed) are written to the display through the BIOS Teletype routine. Although the first 24 lines written to the display do not involve scrolling, all the remaining lines scroll the display.

Reletive Times
(Compaq Deskpro 386 (16 MHz) =100)

478 01

Performance Times (Times given in seconds except where noted)	NOP	80386 Instruction Mix	Floating-Point Calculation	Conventional Memory	DOS Disk Access (milliseconds)	BIOS Disk Seek (milliseconds)	Direct to Screen	Video BIOS Routine Without Scrolling	Video BIOS Routine with Scrolling
8-MHz IBM PC AT with IBM EGA	4.2	9.0	35.6	1.3	42.5	37.2	9.0	7.3	11.2
IBM PS/2 Model 80-071	2.1	4.4	15.6	0.6	33.3	33.6	6.6	0.9	3.7
Compaq Deskpro 386 (16 MHz)	2.1	4.0	15.5	0.8	33.3	29.2	7.9	1.5	4.8
IBM PS/2 Model 80-111	1.7	3.2	12.7	0.6	34.9	32.7	6.5	0.8	3.5
Compaq Deskpro 386/20	1.7	2.9	10.5	0.4	19.4	19.4	1.8	0.6	1.3

Inside the IBM PS/2 Model 80-111

One of the new features designed for the IBM PS/2 Model 80-111 is a proprietary daughtercard that holds 2MB of RAM in 24 80-nanosecond chips (750 kilobits per chip). One bit per byte is reserved for parity checking.

An IBM-made 115MB hard disk is standard equipment on the PS/2 Model 80-111, complete with a 16-MHz (data transfer rate) ESDI controller. Its average access time is 32.7 milliseconds, and performance is enhanced by the logical simulation of 64 heads.

Power supply

1.44MB 3½-inch floppy disk drive

3½-inch disk drive bay

5¼-inch disk drive bay

ESDI controller

Model 8514 display adapter

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CIRCLE 306 ON READER SERVICE CARD

known, IBM provides a vending machine/pay phone–style round keylock that mechanically latches the lid on. Logical access to the computer is governed by built-in password support in the machine's BIOS firmware. Three levels of protection are available: for the whole system, network use, and the keyboard alone.

Once you crack open the chassis, you'll see the businesslike interior of a minicomputer. The design and mechanical construction rate as excellent, particularly from the points of view of simplicity, serviceability, and cost reduction.

As with the Models 60 and 80 before it, the Model 80-111 is not a no-tools design like the low-end PS/2s but an amalgamation of subassemblies. Of these, two metal skeletons, anchored to and stiffening the plastic monocoque, provide the mountings for disk drives.

A sheet-metal and plastic frame at the front and near the top of the chassis forms a nest for the 3½-inch floppies. The drives slide home through the removable plastic front bezel of the chassis. The central spine of the case—the full-length 5½-inch drive mounting rack—is a vital structural member. It also provides the latch area for the capture screws of the cover.

Mounting each of the two full-height devices in this rack involves either dropping it in the center of the rack or squeezing it through the front panel, then sliding it into place. Each device is held in position by two large pressure screws designed to be turned by the palm of your hand to clasp down on the drive mounting rails.

The full front-to-back length of the top Model 80-111 case is filled by the large chrome box of its 225-watt power supply. As with all current IBM units, this power supply automatically adjusts itself to any standard power source in the world in two ranges: 100–125 and 200–240 volts.

At the bottom-front of the chassis is an almost vacant area in which the combined 3-inch loudspeaker and lithium battery assembly (the same assembly as in the other PS/2 models) occupies a small corner. Around the innards of the Model 80-111, you find a purposefully arranged assortment of cut foam that serves both to absorb sound and to channel the air flow. In addition, a plastic plenum directs the inward airflow—sucked through the chassis by

the power supply fan—over the expansion board area before the air courses through the rest of the machine.

The standard keyboard is the familiar 101-key IBM Enhanced keyboard that incorporates all the features everyone seems to demand (top-row function keys, separate cursor pad) and a few bothersome innovations (like the funny Ctrl-key location) as well. Nevertheless, the Enhanced keyboard features IBM's famous positive over-center feel, a slightly thin but still reassuring keyclick, and indicators for locking Shift keys.

Neither PC-DOS 3.3 nor OS/2 are standard with the system, but the Model 80-111 will run either even without additional memory enhancements. Cassette BASIC is still built into the BIOS.

IBM includes a 1-year limited warranty with the Model 80-111, stipulating carry-in service. That means you're responsible for getting the computer back to the shop. Now you know what that big handle on top of the case can be used for.

DREAM BREAKER As with the earlier 16-MHz Model 80s, the Model 80-111 is a smooth-running, tightly integrated system. Nothing can be faulted in the hardware or design (except that you've got to remove either the power supply or the hard disk rack to get the planar board out for service). IBM's engineers have done a good job. The Model 80-111 ranks among the best personal computers available.

But it's not the best.

Return to the daydream recipe you first conjured up for the perfect PC, and you'll see one glaring omission: backward compatibility. That's the price you have to pay for the advantages of the Micro Channel, or so we've been led to believe by IBM's marketing force.

As it turns out, however, there's still a lot of power to be wrung out of the old-fashioned PC bus. Compaq, with its professed commitment to 7-year-old bus design, has out-engineered IBM's own miracle channel and blessed their Deskpro 386/20 with so much speed that it leaves the Model 80-111—and every other PC in the world—caught in the eddies of its supersonic wake.

The Deskpro reveals the many-forked data pathway of the Micro Channel to be a

dubious virtue when what you want is performance. The strength of the Micro Channel—the ability to host multiple processors on the same bus—still lies in the future. In fact, while the Micro Channel may prove advantageous for running a video coprocessor, the VGA performance of the Deskpro makes an superiority doubtful.

Looking beyond performance issues, the Model 80-111 bears more evidence of IBM moving its mainframe marketing strategies into the PC arena—perhaps the outcome of IBM's internal restructuring that pulled PCs closer to its business mainstream.

IBM's big blue mainframe boxes are not the top-performing computers in the world; they are just the best-selling. Of course, they are well made and have enviably low failure rates. If they weren't good values, IBM wouldn't be the largest computer company in the world. The Model 80-111 fits the same product mold.

Its pricing, too, fits the mainframe mold. Unlike earlier IBM efforts that appeared to be cost-driven—figure out what it makes, add a profit, and hang a tag on the machine—the PS/2 series is performance-driven. If you want a computer that's 25 percent faster, you've got to pay nearly 25 percent more. The underlying idea is that the cost per megaflop is nearly the same across the product line, tapering toward the top to give you slightly more for your money the more you spend.

That's where the Model 80-111 fits in. It's not the fastest, but it is well designed and will likely prove to be rugged and reliable. It will get the job done, be it drawing like a workstation, dishing out data as a file server, or just crunching words and numbers 5 to 15 times as fast as an XT.

Is the Model 80 a bad bargain? That depends on how you look at it. If you want PC compatibility or the fastest personal computer currently available, the message from the Model 80-111 is clear: look elsewhere. If you want the security of the IBM label, good performance, and the promise of great things in the future, you'll want to consider the Model 80-111. ∎

Winn L. Rosch is a contributing editor of PC Magazine.

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intel®

PETITION OUT ON A LIM.

BUILTfor
SPEED:
9,600-bps MODEMS

Good decisions require good information—data that can be speedily gathered, plugged into a report, and delivered to the boss's desk. Like desktop messengers, PCs retrieve data—from hard disks and, with the help from a modem, from other PCs.

PC-to-PC communications put other people's data within our reach, minutes away. They eliminate the inconvenience of producing reports to be messengered to other locations, but—if the files you need are long—they also can tie up telephone lines and result in exorbitant telephone bills.

Technology has brought us a long way from the days of 300-bit-per-second modems when sending a 100K file would tie up the phone line for more than 50 minutes. The 1,200-bps modems cut that time

High-speed modems can transmit your files four or even eight times faster than the modem you may now be using.

to somewhat more than 15 minutes; 2,400-bps modems to around 8 minutes.

Within the last 18 months, manufacturers have brought 9,600-bps modems to market. This is not equipment to be used simply to connect to CompuServe or to chat with friends on a local bulletin board. It is high-speed, high-cost equipment, able to send messages at four times the speed of a 2,400-bps modem and bearing price tags that can top $2,000. It is ideal for corporate use, where people need to send truly large files—budgetary analyses, perhaps, or all of last year's figures on sales activity in the West and South. They are also good vehicles for remote access to distant computers, minicomputer gateways and LAN to LAN bridges.

The 13 high-speed modems that we reviewed—the Cermetek 9600E, the Codex 2260, Data Race's PC-Race 24/96, the Fastcomm 2496-T, the Gandalf Access Series V.32, the Hayes V-Series Smartmodem 9600, the Microcom AX/9624c,

the Racal-Vadic 9600VP, Telebit's Trail-Blazer Plus, the Telenetics 9600E, Universal Data Systems' UDS V. 32, U.S. Robotics' Courier HST, and Ven-Tel's Pathfinder 18K—were all compatible enough to be used with PC telecommunications software that supports the Hayes AT command set. The products range in price from $795 to $2,095.

IN THE BEGINNING Codex made the first 9,600-bps modem. It appeared in the early 1980s, sold for about $10,000, and was designed for mainframe communications. It is within the last year and a half that high-speed, 9,600-bps modems have become affordable and practical for PC communications. But attempting to choose the right one certainly can be a difficult proposition.

Until recently, buying a modem was relatively easy because you didn't have to worry much about compatibility. All modems of a given speed used the same modulation scheme. Regardless of what make or model of modem was at the other end of the line, your modem could talk to it. The standards that established this compatibility evolved from the exclusive hold AT&T had over telecommunications in the days before deregulation. For a long time, the only modems you could legally use were made and rented to you, just as telephones were, by AT&T. In fact, AT&T didn't even use the word *modem*. The devices were called "dataphones."

An FCC ruling in the mid-1970s, however, brought competition into the market and made it legal for people to connect non-AT&T devices to the phone lines. Just as new telephone manufacturers arose to challenge AT&T's Western Electric, other vendors began getting into the modem business. The modulation schemes of the dataphone became the standards, and modem manufacturers made their products compatible with the Bell 103 (300 bps) and Bell 212 (1,200 bps) dataphones. Those standards on 300- and 1,200-bps modems remain in place. But by the time 9,600-bps modems appeared on the scene in the early 1980s, many vendors were in the business. Without a single industry leader to dictate the new standards, the role became that of the Consultative Committee for International Telegraph and Telephone (CCITT), a technical and scientific standards group based in Europe.

WEIGHT OF LAW Although CCITT activities are technically called "recommendations" rather than "standards," they often have the impact of law. Members of the CCITT are national governments; in most European countries telephone systems are government monopolies, and it is actually illegal in some countries to use modems that don't follow CCITT recommendations.

■ Within the last year and a half, 9,600-bps modems have become affordable and practical for PC communications

The recommendations that resulted in standards on 2,400-bps modems were straightforward and widely adopted. But unfortunately, in the area of high-speed modems, technology has moved faster than the CCITT. And the technical complexity of performing high-speed communication has confused the issue. The CCITT has actually issued two recommendations on 9,600-bps modems. Neither is completely satisfactory for general PC communications.

The V.29 standard, which is used in almost all fax machines, defines a half-duplex 9,600-bps modem, and the V.32 standard defines a full-duplex device.

Almost all standard PC communications software requires full-duplex modems. But V.32 modems tend to be much more pricey: they average about $2,500 each. The reason? The bandwidth of a telephone network is limited. Where standard 1,200-bps modems can send and receive data on a telephone line at the same time, a 9,600-bps modem consumes all available bandwidth to send data in one direction. After data tones are sent by a V.32 mo-

dem, they must be echoed back along the same line so that the modem will recognize that the data arrived safely. However, the V.32 modem must be able to recognize that the echoes are echoes and not incoming data. For this reason, the V.32 modems require special echo-cancellation circuits that let the modem keep track of what's been sent, compare it with what's coming in, screen out the echo, and receive only the data that was intended for it—not a copy of what it just sent. This circuitry adds about $500 to the cost.

In an effort to produce affordable high-speed products for the PC market, modem manufacturers have developed several ingenious—and incompatible—approaches that use less-expensive modulation schemes to emulate full-duplex operation. In general these are termed pseudo-full-duplex modems, sometimes misleadingly called "asymmetrical."

PING-PONG PROBLEMS The most popular approach, represented here by the Fastcomm 2496-T and Data Race's PC-Race 24/96's BMX mode, has been to combine the widely available V.29 technology and the Rockwell V.29 modem chip set with a microprocessor and memory for buffers. This allows you to make a half-duplex modem that would automatically turn the line around when there was data in the receiving modem's transmit buffer. This so-called "ping-pong" method works fine for file transfers where the line needn't be turned around often. However, it can cause problems in more-interactive applications because standard V.29 devices take 253 milliseconds—over ¼ of a second—to turn the line around and train to the line conditions. Training allows two modems to determine the condition of the telephone line so that they can use the appropriate frequencies and protocols to transfer data.

Modem manufacturers looking for better performance in interactive applications needed faster-training half-duplex modems. These are represented in this review by the Microcom AX/9624c, in which Microcom designed the modem to drop down in speed to 1,200- or 2,400-bps full-duplex when there is data in both modems' buffers. This is also the approach taken in the Racal-Vadic 9600VP. Both are developed

GLOSSARY OF TERMS

ASYMMETRICAL MODULATION
The process through which a modem working in a full-duplex environment will simultaneously transmit data in two directions at different speeds. An asymmetrical modem may offer high-speed transmission in one direction, low-speed in the other.

BAUD A state transition between two distinguishable nominal values on the communications line, or the number of these transitions per second. While this term is often used to mean bits per second (bps), each transition may represent more than 1 bit. The misuse arises because on a standard RS-232 interface, each transition represents one bit.

BELL 103 The American standard for 300-bps full-duplex modems, developed by AT&T prior to a mid-1970s FCC ruling permitting competition by other manufacturers of communications products.

BELL 212 The American standard for 1,200-bps full-duplex modems.

BPS Bits per second. A measure of the speed of a communications device.

CARRIER A tone of a specified frequency that is modified per bit value for sending data via modem. A modem with a carrier frequency of 300 Hz might send 320 Hz tone for a 1 and 280 Hz for a 0.

CHECKSUM A method of describing a block of data, calculated by adding all the bytes in the block together and taking the low-order (right-side) 16 bits. This method will detect single-bit errors and some multiple-bit.

CPS Characters per second. Another measure of the speed of a communications device. Usually 10 bits per character is the standard in PC communications, although 9 bits per character may be used for high-speed transmissions.

CRC Cyclical redundancy check. A more sophisticated method of describing data than checksum. This method is more accurate in detecting multiple-bit errors.

DTE SPEED Data terminal equipment speed. The maximum speed each modem will accept data from its host computer. It is represented in bits per second.

FULL-DUPLEX Allowing simultaneous transmission in both directions. The telephone is an example of a full-duplex communications system.

HALF-DUPLEX Allowing communication in both directions—but in only one direction at a time. Half-duplex systems must have a method of letting the receiving end know that the transmitting end is finished, so that the receiving end can

then transmit. An example would be a two-way radio system, in which the operator says "over" to signal the other operator to speak.

LINE TURNAROUND On a half-duplex connection, the process of changing the direction in which data is being transmitted.

PING-PONG A method of full-duplex emulation on a half-duplex link that provides automatic line turnaround when the receiving modem has outgoing data to transmit.

V.22 The CCITT standard for 1,200-bps full-duplex modems.

V.22 BIS The CCITT standard for 2,400-bps full-duplex modems.

V.25 The CCITT standard of auto-dial commands for modems and other auto-dial devices. Not often used in the United States due to the popularity of the Hayes AT command set.
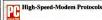
V.29 The CCITT standard for 9,600-bps half-duplex modems, also used in facsimile machines.

V.32 The CCITT standard for 9,600-bps full-duplex modems, not widely used for PC modems due to cost.

—Howard Marks

modems with asymmetrical modulation schemes that provide a 9,600-bps half-duplex data path and a low-speed (typically 200–1,200-bps) data path in the reverse direction, often called the "reverse channel."

U.S. Robotics' Courier HST's and the PC-Race 24/96's interactive mode, use asymmetrical modulation. The Hayes V-Series Smartmodem 9600 uses the same modulation scheme as do V.32 modems, but in a ping-pong fashion, avoiding the cost of echo-cancellation circuitry.

Asymmetrical modems theoretically perform better than ping-pong modems in two types of applications. The first is protocol file transfers, in which the data travels on the high-speed forward channel and the acknowledgment packet takes the low-speed reverse channel. The second is interactive queries, like airline ticketing, in which keystrokes take the reverse channel and screens of data travel on the forward channel. In real life the reverse channel is often too slow to handle some applications, so it is also important for the modem

to turn the line around quickly.

Both Telebit's TrailBlazer Plus and Ven-Tel's Pathfinder 18K, which uses Telebit technology, follow a unique multicarrier modulation scheme that theoretically makes the most of the available bandwidth. Rather than use one carrier frequency and heavily modulate it to carry 4- or 5-bit-per-state transition (baud) and many transitions per second, Telebit chose to divide the available line bandwidth into a large number of carriers, whereby each carries a small amount of data. When two

High-Speed-Modem Protocols

High-speed modems send and receive data using three basic protocols: V.32 full-duplex, asymmetrical, and ping-pong. With the V.32 full-duplex protocol, two modems can exchange data at a rate of 9,600 bits per second in both directions at the same time. It works much like a telephone; two people can talk at the same time. Asymmetrical protocol allows the sending modem to transmit a file at a rate of 9,600 bps; at the same time, the receiving modem is able to transmit data back to the sender only at a rate of 300 bps. With the ping-pong protocol, data will travel in either direction at the last rate of 9,600 bps—but the modems cannot share the line. Data moves in only one direction at a time, but the modems will quickly reverse the direction of transmission, or turn the line, when the receiving modem has data to transmit. This process is comparable to that of two-way radio communications, in which only one radio operator can speak on a single frequency at a time.

V.32 FULL-DUPLEX PROTOCOL

Sender — Data moves at 9,600 bps → Receiver

Sender ← Data moves at 9,600 bps — Receiver

ASYMMETRICAL PROTOCOL

Sender — Data moves at 9,600 bps → Receiver

Sender ← Data moves at 300 bps — Receiver

PING-PONG PROTOCOL

Sender — Data moves in one direction at 9,600 bps → Receiver   PING

Sender becomes receiver ← Data moves in one direction at 9,600 bps — Receiver becomes sender   PONG

modems using this technology connect, they send tones across the line and determine which of 500 possible carriers can be used on the phone line in each direction. From there on, the modems use those carriers and emulate full-duplex operation in a ping-pong fashion.

NEW STANDARDS—AND COSTS

The CCITT has formed a study group to look at all these schemes and the compatibility problems that may result, but the earliest they are expected to actually produce a standard is 1992. Before then it is quite likely that the market will identify a de facto standard and the CCITT will just end up endorsing it.

Just a year ago the most-inexpensive V.32 modems were priced just over $2,500. Now the UDS V.32 is priced at $1,595, less than 20 percent under some of the more-expensive pseudo-full-duplex modems. The price erosion began with Rockwell's introduction of its 9,600-bps modem card. The card has all the features of a V.32 device, including the RS-232 interface. All a manufacturer has to do is add a Hayes-compatible auto-dialer and cabinet. Rockwell is selling the card for $450 in quantities of 1,000, and we should expect to see modems based on this card appear in the market sometime this summer. Price erosion may affect standards if it produces a clear market leader.

If the uncertainties about standards and price cause you concern, you may want to delay a planned purchase of a 9,600-bps modem until you see the results. Other alternatives for fast file transfer are available. Fax boards include a V.29 modem, and most fax boards come with software to transfer text files to another fax board of the same brand. Another alternative, especially for interactive applications, is to look at a 2,400-bps modem with MNP Class 5 or the Hayes V-Series Smartmodem 2400. These modems are about 60 percent faster than regular 2,400-bps modems, and since they're real full-duplex devices, they will work better in a LAN-to-LAN bridge than will a ping-pong 9,600-bps modem. The Hayes modem enhancer gives the same speed improvement to your existing 2400.

If you have an immediate need for high-speed communications, do take a close

look at these modems. The best of them work well at most tasks—and any of them save hours when transferring large files. However, don't expect that what you buy will become an industry standard. Many of these modems could become obsolete if a single standard evolves, though even obsolete hardware can get the job done.

—Howard Marks

CERMETEK MICROELECTRONICS INC.
Cermetek 9600E
TELENETICS CORP.
Telenetics 9600E

The Cermetek 9600E and the Telenetics 9600E are identical in all respects and represent the minimalist school of modem design. No fancy LCD screens or front-panel programming here—just push buttons and LEDs. Cermetek even uses a rather large (11- by 12- by 13-inch) off-the-shelf cabinet. In reality, both these modems are made by Cermetek, and they are priced the same at $1,995.

Like most V.32 modems, the 9600E excels at interactive applications using one of the remote packages like *PC Anywhere*.

Screen and keyboard are both responsive and, as any old-timer who used a CP/M machine with a 9,600-bit-per-second dumb terminal can tell you, 9,600 bps is plenty fast. To paraphrase AT&T, V.32 is the next best thing to being there.

The Cermetek 9600E and the Telenetics 9600E are identical except for their names. They have a simplistic design, distinguished by two wide rows of cooling vents at the top of the cabinet.

The 9600E uses a customized LAP-B (Link Access Protocol-Balanced) error-correction protocol with a 16-bit CRC (cyclical redundancy check) and a maximum block size of 128 bytes. Unlike most error-correcting modems, the 9600E was as responsive with error correction turned on as it was with it disabled.

One nice feature of the 9600E is its internal power supply. It comes as a standard power cord, not one of the huge wall-transformer varieties that many modem manufacturers use. The front panel has LEDs for data terminal ready (DTR), modem ready, transmitted data, received data, high speed, error correction on, and modem check (which flashes if there are any data retransmissions). The 9600E also has push buttons to answer and can manually originate a call that is already dialed, can force 4,800 bps for noisy lines, and can enable error correction.

The 9600E's support only high-speed communications, so you'll need to have a second modem for low-speed applications like calling MCI Mail. Cermetek has announced a new model—the 9600FR—that will add 300-, 1,200-, and 2,400-bps communications to the 9600E.

The 9600E supports the basic Hayes Smartmodem 1200 AT command set, but there were problems with almost every communications package tested on it. The problem is in the way that Cermetek handles some of the RS-232 control lines—by tying carrier detect (CD), data set ready (DSR), and clear to send (CTS) together so they all go high or low at the same time. Most communications packages expect DSR or CTS to be high before they send commands to the modem, and then expect CD to go high when the two modems have established a connection. On the 9600E you can set a DIP switch to make all three lines high all the time (making your software think there already is a connection) or go high when the two modems are connected (preventing your software from sending commands to the modem). Complicating the situation, the follow carrier detect position is labeled "normal" in the manual. Carbon Copy's memory-resident module won't even load if CTS is low.

Telenetics's documentation seemed a bit easier to understand than the Cermetek manual, but both of them are terse and

could benefit greatly from examples.

Overall, the problems with the RS-232 interface outweigh all the positive features of the 9600E. A PC user shouldn't have to customize his communications software just to make it work with a modem.—Howard Marks

CODEX CORP.
Codex 2260

It's easy to see from the Codex 2260 that Codex Corp. is serious about data communications. With its large size, the protective door over its controls, and its olive-drab paint job, the 2260 is an impressive piece of hardware with a military look about it. It lists for $1,995.

In fact the 2260 is larger (16 by 8½ by 3¾ inches), heavier (over 8 pounds), and—due to its internal fan—noisier than a T1000 laptop computer. Its internal structure is more like that of a computer than a modem. It has a separate power supply, card cage, and a fan.

Its performance, like that of the other true V.32 modems in our test group, was similarly impressive. No matter what we threw at the 2260, it just went its merry way—transmitting its data at 9,600 bps without skipping a bit. While the pseudo-full-duplex modems with data compression can go faster on a clean line, the

The front panel of the Codex 2260 can be opened. Inside is an LCD and push buttons that let you set the modem's operating modes without software or DIP switches.

2260's noisy line performance was flawless—even on lines the pseudo-full-duplex modems failed to work on at all.

In real-world use, the true full-duplex nature of the 2260 makes it perfect for interactive applications like remote operations with programs such as *Carbon Copy* or *PC Anywhere*. Using *WordStar* with *Carbon Copy* was almost as fast as if you were using it on your own PC. Using a 2,400-bps modem with *WordStar* was painfully slow, and with most of the pseudo-full-duplex modems the delays made it hard to tell what was going on. It was easier to copy the file to my PC, edit it, and then copy it back.

The only trouble I had with the 2260

■ **No matter what we throw at the Codex 2260, it just went its merry way—transmitting its data at 9,600 bps without skipping a bit.**

was when I tried to use it with Hayes's *Smartcom II*, well known for not working with "Hayes-compatible" modems. Other communications packages—including *Carbon Copy* and *Crosstalk XVI* and *Mk.4*—were not only compatible, but worked without a hitch.

In addition to the basic Hayes AT commands, the 2260 has its own Codex command set. Since Codex's primary market comprises data centers and mainframe terminal users, and you can't run software on a terminal, the developers try to make it as easy to use as possible.

In that spirit they also gave the 2260 an LCD and several front-panel buttons that let you set all the modem's operating modes without software or DIP switches. Codex even added a handy pull-out reference card with a magnetic cover attached to the protective cover of the 2260 where you easily can find it.

If you have a hostile environment like a

factory and need good interactive performance, you should consider the 2260. However, the 2260 doesn't support low-speed operation and doesn't have error correction or data compression—the price you pay to get this kind of quality for only $1,995.—Howard Marks

DATA RACE INC.
PC-Race 24/96

Data Race's PC-Race 24/96 is unique among the modems reviewed here on two counts: it is the only internal modem that we tested, and it is also the only modem we tested that supports two different high-speed modulation schemes. The PC-Race comes with both a V.29 ping-pong mode and an asymmetrical modulation mode.

Theoretically, the ping-pong method is optimized for fast file transfers where all the data is traveling in one direction; the asymmetrical mode that has a 9,600-bit-per-second forward channel and a 200-bps low-speed reverse channel is better for more-interactive applications. In reality,
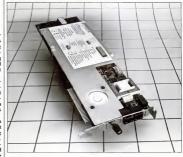
even during file transfers, error-correction acknowledgements have to go back to the sending modem, forcing line turnarounds and reducing the advantage of the ping-pong method.

The Data Race PC-Race 24/96, a full-slot internal modem, bears a label with instructions on setting its switches and jumpers. It also has a knob for volume control and two phone jacks.

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DATASTORM
DATASTORM TECHNOLOGIES, INC.

EASY SETUP .The PC-Race is made up of a motherboard and two modem modules—one each for the low-speed and high-speed modems. PC-Race is a full-slot piggyback card—but it's not so thick as to interfere with adjacent cards. Setting up the PC-Race is a breeze. Instructions for all switches and jumpers are printed right on the modem. You can buy the PC-Race with both high- and low-speed modems installed for $995 or with just your choice of high-speed ($795) or low-speed ($595) and upgrade later to support both.

With the low-speed board installed, the PC-Race supports all the usual 300-, 1,200-, and 2,400-bps standards, including the V.22 1,200-bps standard used overseas. The V.22 supports the basic Hayes command set as defined by the Hayes Smartmodem 1200 and has additional commands and S registers to control those functions, like error correction, that the Hayes didn't have. *Crosstalk XVI* and *Mk.4* worked with the PC-Race without a problem, but like most "Hayes-compatible" modems the PC-Race would not run with *Smartcom II* or *III*. The PC-Race uses MNP Class 4 in its low-speed modes and a proprietary 16-bit CRC error-checking protocol in its high-speed modes.

In noise testing, the PC-Race performed very well, maintaining its performance on even the worst lines we threw at it. This was impressive since most of the other pseudo-full-duplex modems either dropped the line or fell back dramatically when the line got bad.

While Data Race claims throughput up to 19,200 bps, our testing in the Labs showed that these speeds are possible only when sending identical characters. The PC-Race's data compression system was more variable than either the Hayes or MNP Class 5 techniques, and the PC-Race's throughput on text was 50 percent less than the identical data pattern as compared with a 15- to 20-percent speed reduction for the others. In fact the PC-Race was only slightly faster transmitting text than it was transmitting random 8-bit data. Its data compression scheme just isn't very effective with text.

The PC-Race's character turnaround performance was also disappointing, especially in interactive mode—where it took 179 milliseconds to echo a character. In

real-world use, these delays shouldn't be especially bothersome in interactive mode. In block mode they weren't as bad as some of the other modems in our tests, but the delays were a bit disconcerting, with characters often appearing on the screen in clumps.

Putting a good interactive mode and a good block-transfer mode in the same modem and charging a reasonable price for the whole thing seem like good ideas—but neither mode is so good as to make up for the other's mediocre performance. Data Race would have a better product if its designers had perfected one mode or the other, rather than having spent their time developing both.—**Howard Marks**

FASTCOMM COMMUNICATIONS CORP.
Fastcomm 2496-T

One of the first high-speed modems in the PC market, the Fastcomm 2496-T is showing its age. The Fastcomm uses Rockwell's V.29 chip set, which is also used in many fax machines. Using the old chips results in the Fastcomm having a very slow

character-turnaround time.

In fact the slow character turnaround is the single most significant feature of the Fastcomm. When I tested it on several bulletin boards that use the Fastcomm modems, the echo came so late that I answered questions twice and often hit extra returns. The slow line turnaround even

The Fastcomm 2496-T is a no-frills box with only a volume control and status lights on its front panel. The modem is cooled by six tiny cooling vents above the LED display.

made screens appear in fits and starts, since the modem had to turn the line around to send the acknowledgment packets for its proprietary LAP-B–based (Link Access Protocol-Balanced) error-correction scheme.

The Fastcomm line turnaround is so slow because the two modems must train, or adjust, themselves to the quality of the

■ **The Fastcomm 2496-T's turnaround is so slow that some Xmodem implementations may time-out before they receive the acknowledgment.**

line each time the line is turned around. This training takes about a quarter of a second—and if you have error correction turned on, the line must be turned several times for each echo. In our tests it took over a second and a half for each character to be echoed. In real life you'll find your characters echoed in bunches.

SLOW CONNECTION The Fastcomm also takes a while to get connected (up to 30 seconds in our tests), so you may need to adjust your software to wait for the carrier longer than you would for a standard modem.

Since the Fastcomm was specifically designed for file transfers, it performs them much better than a general-purpose modem. Its data compression really helps move the data sent over 1,000 characters per second on a perfect line. The line turnaround problem reappears when we use a file-transfer protocol; throughput drops to just 76 cps if we use Xmodem-like 128-byte blocks and to 414 cps with a 1K block protocol. Fastcomm users should just use protocols like Ymodem-G or Zmodem that send data back only if there is an error. In fact, the Fastcomm 2496-T's turnaround is so slow that some Xmodem implementations may time-out before they are able to

receive the acknowledgment.

The Fastcomm manual is better than average and includes directions on setting up popular PC communications packages—including *Crosstalk XVI, Relay Gold, Carbon Copy,* and *Blast*—for the Fastcomm. Fastcomm provides a copy of *Qmodem,* one of the more-powerful shareware communications packages, with their PC and external models.

The 2496-T is a "Hayes-compatible" 2,400-bit-per-second modem, and Fastcomm also makes a 2,400-bps modem that can be upgraded to the 2496, as well as a 9,600-bps-only version that can be field upgraded to have all the 2496 features. The 2496 supports the basic Hayes command set from the Hayes Smartmodem 1200 and has several additional commands that are implemented differently than on Hayes's newer models. I had no problems using the Fastcomm as a normal modem except on Hayes's *Smartcom*—which assumes that a 2,400-bps modem supports the full Hayes Smartmodem 2400 command set.

Unfortunately, neither the data-compression nor error-correction features of the 2496 work when using the modem at lower speeds.

NEW MODEL DUE SOON Fastcomm could improve this product without too much difficulty by adding MNP error correction to the 2,400-bps mode, and by making the modems drop down to 2,400-bps mode during interactive type processing—thereby eliminating the terrible character turnaround delay. Since it uses the same modulation scheme as fax machines anyway, Fastcomm could also sell software to allow you to send faxes using your modem.

The 2496-T is available in a half-card PC bus internal, external, and rack-mount versions. Fastcomm has also announced a new model that uses asymmetrical communications like the U.S. Robotics or Data Race interactive mode. This should be much better at interactive operation and standard protocol transfers.

Unless you have an installed base of Fastcomm modems or special file-transfer applications that don't require operator interaction, you should look at other modems before the Fastcomm. Its slow line turnaround and lack of standard error-correction protocol make it a poor choice

when compared with the other modems reviewed here.—Howard Marks

GANDALF DATA INC.

Gandalf Access Series V.32

The Gandalf Access Series V.32 does things well but always in its own way. One of the few V.32 modems that also supports low-speed communications, it also uses the CCITT V.25 command set (a trait unusual in a modem).

Like the rest of the V.32 modems in our test sample, the Gandalf performed flawlessly on our noise tests and echoed characters on the character turnaround test so quickly that you would have to set a new world record in typing speed to notice any delay, although some of the modems were faster in transmitting data with data compression was faster in transmitting data.

Smaller than most of its V.32 competitors, the Access Series V.32 has four rocker switches and ten LEDs on its front panel. There are LEDs for power, transmitted and received data, clear to send (CTS), carrier detect (CD), data terminal ready (DTR), off hook, auto-answer (which also flashes when the phone is ringing), error control (which is lit in error-correction mode), and test status.

SWITCH CONTROLS The switches control the modem's self-test features, switch it between voice and data mode, and select any of its three command set modes. Mode 1 sets up the modem as a low-speed, 2,400-bps, Hayes AT command-set-compatible device. Mode 2 is

FACT FILE

Gandalf Access Series V.32
Gandalf Data Inc.
1020 S. Noel Ave.
Wheeling, IL 60090
(312) 541-6060
List Price: $2,095
Requires: RS-232 cable.
In Short: A quality V.32 modem that also supports low-speed modes. However, a poor manual makes it difficult to set up—even for experienced users.
CIRCLE **694** ON READER SERVICE CARD

Smaller than most of its competitors, the Gandalf Access Series V.32 has two rocker switches on either side of its LED display. Cooling vents line the sides of the modem.

also Hayes compatible and adds high-speed communications. Mode 3 uses the CCITT V.32 command set to control the modem for both high- and low-speed operation.

Normally, PC users would just set the switches for mode 2 and go their merry way, but unfortunately some of the modem settings, which Gandalf calls "straps," can be set only by using the V.25 commands. This inconvenience is complicated by the fact that the Gandalf manual is written in British English and is often confusing.

Clearly not written with PC users in mind, the manual uses CCITT names and numbers for the RS-232 control line rather than the Electronics Industry Association names that PC users are more used to. For example, DTR becomes 180.1 or terminal ready (TR), and CTS is 106 or modem ready (MR). Unfortunately, support is hard to find: Gandalf's address and telephone number are nowhere to be found in the user manual.

The back panel, inset about an inch from the back of the case, makes it awk-

> ■ The Gandalf echoed characters so quickly that you would have to set a new world record in typing speed to notice any delay.

ward for you to plug in the ribbon cables. On the plus side, the Gandalf Access Series V.32 has a standard power cord that conveniently connects to the mains—so you don't need to find space for a huge transformer on your power strip.

The Access Series V.32 is a good modem greatly crippled by a bad manual. Gandalf could make it a better product by investing in some professional writing talent.—**Howard Marks**

HAYES MICROCOMPUTER PRODUCTS INC.
Hayes V-Series Smartmodem 9600

The Hayes V-Series Smartmodem 9600 is a relative newcomer among high-speed modems. Being from Hayes, however, it's also the one with which others inevitably will be compared. On some points, as you might expect, the Smartmodem scores well indeed. Even on its weakest points, it scores well enough.

One of the $1,299 Smartmodem 9600's best points is ease of use. While every modem in today's PC market claims Hayes compatibility, some are more compatible than others. Their differences can translate into problems in installation—often forcing a search through your modem and communications program manuals before you can use the two together.

Not so with the Hayes Smartmodem. Virtually every communications program includes Hayes Smartmodem as an installation choice. In many cases there are even separate choices for the Smartmodem 1200 and the Smartmodem 2400.

The Smartmodem 9600, you can be sure, will soon rank among the choices as well. Until then, the choice of the Smartmodem 2400 will usually do. Like the 2400, the Smartmodem 9600 has no DIP

PC High-Speed Modems: Summary of Features

(Products listed in ascending price order)

	Courier HST U.S. Robotics Inc.	PC-Pace 24/96 Data Race Inc.	Racal-Vadic 9600VP Racal-Vadic	Fastcomm 2496-T Fastcomm Communications Corp.	Hayes V-Series Smartmodem 9600 Hayes Microcomputer Products Inc.	TrailBlazer Plus Telebit Corp.	Microcom AX/9624c Microcom Inc.
	$995	$995	$995	$1,099	$1,299	$1,345	$1,399
LOW SPEEDS							
300 bps	●	Optional	●	Optional	●	●	●
1,200-bps Bell 212	●	Optional	●	Optional	●	●	●
2,400-bps V.22 bis	●	Optional	○	Optional	●	●	●
TOP SPEEDS							
Data compression	●	●	○	●	●	None	●
Fallback (bps)	9,600, 7,200, 4,800	4,600	7,200	7,200	None	In 100-bps increments	7,200
Fell forward					○		
Maximum DTE speed (bps)	19,200	19,200	9,600	19,200	19,200	19,200	19,200
DIP switches	●						
Front-panel control	○	○	○	○	○	○	○
HAYES COMPATIBILITY							
1200 (original command set)	●	●	●	●	●	●	●
2400 (extended command set)	○	○	○	○	●	○	●
Dialing commands only	○	○	○	○	○	○	○
ERROR-CORRECTING PROTOCOL							
High speed	Modified MNP	Proprietary	MNP Class 3	Proprietary	Proprietary, AFT	PEP	MNP Class 6
Low speed (2,400 bps and below)	MNP	MNP Class 3	MNP Class 3	None	None	MNP	MNP Class 5

	Pathblazer 18K Ven-Tel Inc.	UDS V.32 Universal Data Systems	Cermetek 9600E Cermetek Micro-electronics Inc.	Codex 2260 Codex Corp.	Telenetics 9600E Telenetics Corp.	Gandalf Access Series V.32 Gandalf Data Inc.
	$1,399	$1,596	$1,995	$1,995	$1,995	$2,095
LOW SPEEDS						
300 bps	●	○	○	○	○	●
1,200-bps Bell 212	●	○	○	○	○	●
2,400-bps V.22 bis	○	○	○	○	○	●
TOP SPEEDS						
Data compression	●	○	○	●	○	○
Fallback (bps)	In 200-bps increments	None	4,600	4,600	4,800	4,500
Fell forward	●					
Maximum DTE speed (bps)	19,200	9,600	9,600	9,600	9,600	9,600
DIP switches	○					
Front-panel control	○	●	○	●	○	○
HAYES COMPATIBILITY						
1200 (original command set)	●	●	●	●	●	●
2400 (extended command set)	○	●	○	●	○	○
Dialing commands only	○	○	●	○	○	●
ERROR-CORRECTING PROTOCOL						
High speed	Proprietary	V.32	Proprietary	None	Proprietary	Proprietary
Low speed (2,400 bps and below)	MNP Class 3	None	None	None	None	Proprietary

■ =Indicates Editor's Choice ● =Yes ○ =No

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Hayes kept to its familiar design with the V-Series Smartmodem 9600. The front panel sports the same set of status lights as do other Hayes modems. There are no vents.

switches; it stores all modem settings in nonvolatile memory. More important, it has essentially the same command set, so that any program designed for the Hayes 2400 should work with the Hayes 9600.

During testing, the 9600 worked swimmingly with *Relay Gold* and *Crosstalk Mk.4*, set for the Smartmodem 2400. As expected, it also worked with *ProComm*, *Crosstalk XVI*, *Smartcom II*, and *Smartcom III*.

Another plus is the modem's speedy turnaround time. The 9600 managed a character turnaround time of 112 milliseconds—about $1/10$ second. The only faster times were for the more expensive, full-fledged V.32 modems.

SIMILAR APPEARANCE Physically, the Smartmodem 9600 is about $1/4$ inch taller than the Smartmodem 2400. Otherwise they are nearly identical—so much so that you might not notice the difference if the label 9600 wasn't written on the front panel. As with other Smartmodems, the unit is just the right size to fit under a stan-

dard, single-line desk phone.

The modem's front panel sports the same set of status lights as do other Hayes modems: modem ready (basically a power-on light), terminal ready, receive data, send data, off hook (the modem has picked up the phone), carrier detect (the modem is talking to another modem), auto-answer, and high speed.

But one shortcoming here concerns the high-speed light—or rather the lack of an additional speed lights. The light comes on to indicate a 9,600- or 19,200-bit-per-second connection to the computer. Ideally, it would be helpful to know which speed the modem is using.

Also troublesome is that no indicator distinguishes between a 2,400-bps and a 1,200-bps connection. The modem can be set to report the speed when establishing the link, but with some programs you have to turn off this feature to avoid confusing the software.

As do other high-speed modems, the Smartmodem 9600 has built-in error-correction and data-compression schemes.

Error correction in the Smartmodem 9600 uses a proprietary enhancement to the CCITT LAP-B (Link Access Protocol-Balanced) error-correction protocol. The data compression scheme is also proprietary.

UNSHARED STANDARD What's nice is that the modem can use error correction and data compression at 2,400 and 1,200 bps while talking to the Hayes V-Series Smartmodem 2400 or a standard external Smartmodem equipped with the Hayes V-Series Modem Enhancer. Alas, the company so far has chosen to keep this scheme to itself, thereby ruling out the possibility that it may become an industry-wide standard.

In addition to talking to other V-Series modems at slower speeds, the Smartmodem 9600 can talk to most other modems using Bell 103 protocol at 0 to 300 bps, Bell 212 or V.22 protocol at 1,200 bps, or V.22 bis at 2,400 bps. At 4,800 and 9,600 bps, the modem uses a half-duplex variation on V.32 protocol.
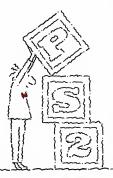
When establishing a link, the modem takes about 13 seconds to negotiate the speed of the link and the presence or absence of data-compression and error-correcting protocols. This period is long enough that you may need to adjust the amount of time your program waits before deciding to cancel a call. No capability exists to adjust the speed of the transfer during a session to compensate for changing line conditions.

On the PC Labs speed test, the Smartmodem managed a respectable 1,129 cps—which placed it well below the 1,538 cps for Telebit's TrailBlazer. In the PC Labs Xmodem test, the Smartmodem ranked in the middle of the pack but remained ahead of everything else except the full-fledged, full-duplex V.32 modems.

On noise tests, the Smartmodem again scored respectably but not spectacularly, failing only when facing a more-than-average amount of noise on a worse-than-average line.

All told, the Smartmodem 9600 is exactly what you'd expect from a company of Hayes's stature. It's a reliable unit with respectable performance and a high degree of compatibility with earlier Hayes modems. That, plus Hayes's well-deserved

reputation for support, may be enough to make the Smartmodem 9600 your modem of choice.—**M. David Stone**

MICROCOM INC.
Microcom AX/9624c

As might be expected from the inventors of the Microcom Networking Protocol (MNP), the Microcom AX/9624c uses the latest MNP Class 6 for full-duplex emulation as well as data compression and error correction. The AX/9624c uses the CCITT standard V.29 half-duplex modulation scheme for high-speed communications.

In addition to V.29, the AX/9624c supports the standard schemes for 300- to 2,400-bit-per-second communications including the Bell 103, Bell 212, CCITT V.22 bis and CCITT V.22 standard for 1,200 bps, widely used overseas. Unlike some of the other modems reviewed here, the AX/9624c supports all its MNP features, including data compression, at the lower data rates. The only exceptions are those features that are specifically designed for half-duplex modems since all the lower-speed modes are truly full-duplex.

The AX/9624c uses Rockwell's latest V.29 chip set and its proprietary fast-train mode, which lets the modems adjust to the condition of the telephone line in 23 milliseconds—compared with the CCITT standard 253-milliseconds training time. This fast-train mode let the AX/9624c echo characters in our Labs tests just 140 milliseconds after they were sent. In real-world testing, we found the AX/9624c's full-du-

The Microcom AX/9624c has two push buttons and seven status lights on its front panel. Cooling vents line the three back edges of this sleek black modem.

plex emulation quite good.

The Microcom's data compression was also impressive. When transferring a highly compressible file consisting of several thousand lowercase *e*'s, the AX/9624c managed to transfer more than 1,850 characters per second. Transferring C language source code reduced throughput to a very respectable 1,400 cps. By comparison, truly random data—which should not be compressible—slowed transfer to 930 cps.

The AX/9624c supports most of the Hayes Smartmodem 2400 command set including the extended AT&T commands. The additional Microcom AT commands use a \ (backslash) delimiter to avoid future incompatibilities.

However, using both PC Labs performance test software and *Crosstalk Mk.4*, the modem would frequently remain online after the program told it to hang up. We also had trouble getting it to respond to the +++ escape sequence that returns a Hayes-compatible modem to the command state. Sometimes it would respond

and at others it would just send the three pluses.

Microcom should work on the documentation for this modem. It has one manual for their 1,200- and 2,400-bps modems and a 24-page photocopied addendum for the AX/9624c. When you take into account the number of registers and commands the AX/9624c has to set, all the MNP features, as well as handshaking and normal modem parameters, you end up doing a lot of paper shuffling to configure the AX/9624c. Buyers of a $1,000 modem deserve a manual written specifically for it. Also confusing is that Microcom modems support a proprietary command set called SX in addition to the more common AT commands, and the addendum alternates instructions for the two modems.

Microcom thoughtfully included both DIP switches and a volume control in the AX/9624c. Many new modems do everything in software, giving you only three volume levels—that are usually too soft, too loud, and much too loud. Similarly, it

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Performance Tests: High-Speed Modems

All high-speed modems are not created equal, as these test results demonstrate. The standard V.32 modems from Universal Data Systems, Cermetek, Codex, Gandalf, and Telenetics all performed about the same, but the pseudo-full-duplex modems—half-duplex ones that emulate full-duplex through a virtually indistinguishable line turnaround—were very different from each other and different from the V.32s.

Among the pseudo-full-duplex modems, the Hayes V-Series Smartmodem 9600, the Microcom AX/9624c, Telebit's TrailBlazer Plus, and Ven-Tel's Pathfinder 18K stand out for the quality of their full-duplex emulation as represented in the Character Turnaround tests, while performances of the Fastcomm 2496-T and Data Race's PC-Race 24/96 were significantly worse than average. Data Race's PC-Race 24/96, in both modes (see review), fared better in the Xmodem test, ranking just behind Hayes's and Microcom's modems.

In throughput tests, those pseudo-full-duplex modems offering data compression—such as Telebit's TrailBlazer Plus, U.S. Robotics' Courier HST, and the Hayes V-Series Smartmodem 9600—stand out by transmitting data up to 50 percent faster than the V.32 standard modems, depending on the type of data being transmitted.

Performance also varied dramatically over noisy phone lines. While all the V.32 modems were essentially unaffected by the levels of noise we used, most of the pseudo-full-duplex modems slowed down as the line got noisier, and failed to transmit at all once the noise reached the ear-splitting levels of -20 to -17 decibels/relative noise.

A low-speed (1,200- or 2,400-bit-per-second) modem is by nature a relatively simple device. It translates data from your PC and converts it to tones that can be sent over the telephone network. And it takes tones it "hears" over the phone line and converts them to data your PC can understand. Low-speed modems differ in how well they can handle line noise and in how well they emulate the Hayes AT command set, but otherwise they operate according to the Bell 212 standards specified by AT&T or CCITT standards.

High-speed modems reviewed here however, face greater obstacles to efficient operation. To overcome the telephone network's limited bandwidth, one approach to high-speed modem design is to send data over the phone line in only one direction at a time. The more-affordable high-speed modems use this half-duplex method and emulate full-duplex modems by using internal buffers and microprocessors. Some models was improve throughput by adding data compression and error correction.

The challenges these products face make testing them much more difficult than testing their low-speed counterparts. We need to test whether the full-duplex emulation works well enough to allow the user to type without having the echoed characters return so slowly that no correct errors we never made. We also need to examine how well the data compression and error correction work, and how well the modem's throughput is impeded by noisy phone lines

For testing we used two IBM PC ATs running software developed specifically for PC Labs. One of those computers we designated the "master", the other, the "slave." The COM1 port of each AT was connected to the modem being tested, while two TAS 1010 channel emulators between them. These channel emulators acted as our telephone network, simulating constant levels of line noise—a must for objective testing of several products.

To communicate timing information between master and slave, we linked the COM2 ports of the two ATs. These ports were connected using a null modem cable to allow the two computers to communicate without any possibility of delay. The master computer also had a connection from its COM3 port to control the TAS 1010 channel simulators.

In the **Character Turnaround** test, we sent a character from master to slave, which immediately echoed it back to the master. The reason? Ergonomic studies by IBM have determined that delays of more than 200 milliseconds are bothersome to some typists. But when the delays reach more than 250 ms , few typists can ignore the distraction, a necessary consideration for a company's purchasing officer. After repeating this process several times we calculated the total round-trip time for each character. The test, in addition, is also a general indication of how well the pseudo-full-duplex modems perform their full-duplex emulation

The **Mixed** and the **Xmodem** tests comprise the summation of a battery of tests designed to determine how fast the modems transmit data on a throughput basis and how well their data-compression features work on various data patterns Several data patterns were transmitted from the master computer to the slave which checked each byte for errors and used the COM2 communications channel to tell the master when it received the last byte 256K bytes of each data pattern were transmitted, and the modem's throughput was calculated in characters per second

In decreasing order of anticipated compressibility, the data patterns were a stream of identical characters C language source code, random 8-bit data and a special progressive data pattern. In the Mixed test, we continued these patterns into a single one to measure the modem's throughput for that pattern using the modem's internal protocol. The Xmodem test measured how well the modems transmitted the mixed pattern data using the error-checking Xmodem protocol. A comparison of the Mixed and Xmodem test results show significant loss in speed of transmission when an external error-checking protocol is used. High-speed 9,600-bit-per-second modems provide internal error-checking mechanisms, which ensure fast, reliable error-free transmission

Performance Times

(Times given in milliseconds)

	Character Turnaround
Fastcomm 2496-T	1,614
PC-Race 24/96 (ping-pong protocol)	248
Racal-Vadic 9600VP	206
Courier HST	196
PC-Race 24/96 (asymmetrical protocol)	179
Pathfinder 18K	160
Microcom AX/9624c	140
TrailBlazer Plus	122
Hayes V-Series Smartmodem 9600	112
Cermetek 9600E	81
Telenetics 9600E	81
Codex 2260	55
UDS V.32	52
Gandalf Access Series V.32	46

Relative Times

(Hayes V-Series Smartmodem 9600 = 100)
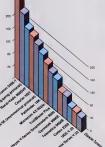
Performance

(given in characters per second)

	Mixed	Xmodem
Fastcomm 2496-T	1,007	76
PC-Race 24/96 (ping-pong protocol)	910	320
Racal-Vadic 9600VP	800	85
Courier HST	1,248	225
PC-Race 24/96 (asymmetrical protocol)	695	317
Pathfinder 18K	1,473	157
Microcom AX/9624c	1,163	334
TrailBlazer Plus	1,538	136
Hayes V-Series Smartmodem 9600	1,129	384
Cermetek 9600E	957	488
Telenetics 9600E	957	488
Codex 2260	957	675
UDS V.32	957	676
Gandalf Access Series V.32	607	957

PC MAGAZINE
Performance Tests: High-Speed Modems

For the other high-speed-modem throughput tests, we set the TAS 1010 channel simulators to emulate a perfect telephone line—that is, with no line noise whatsoever. For the Signal-to-Noise Ratio test, however, we measured each modem's performance on noisy lines.

For this test, we programmed the channel simulators for a worst-case long-distance line and measured the modems' throughput at varying "decibels/relative"

noise" levels. Since the TAS 1010 provides line impairments in only one direction, we connected two TAS 1010s back-to-back to provide a bad line in both directions.

Test results are presented on graphs of throughput in characters per second (cps) versus decibels/relative noise. Line quality decreases from left to right on the graph.

Modems with higher graph lines have higher throughput over a range of noise levels. Higher throughput in this case represents better immunity to telephone-line noise. Some modems were unable to complete all the tests because they stopped transmitting accurately or stopped transmitting altogether at certain noise levels.

Signal-to-Noise Ratio
(Results given in characters per second for each level of decibels/relative noise)

Cermetek 9600E

Codex 2260

Courier HST

Fastcomm 2496-T

Gandalf Access Series V.32

Hayes V-Series Smartmodem 9600

Microcom AX/9624c

Pathfinder 18K

PC-Race 24/96 (ping-pong protocol)

PC-Race 24/96 (asymmetrical protocol)

Racal-Vadic 9600VP

Telenetics 9600E

TrailBlazer Plus

UDS V.32

can be difficult to set up a modem that only uses software commands if you have to change the way it comes out of the box. The DIP switches can be overridden by software commands if different programs require different settings. It's nice to have a choice. It would also be nice to have a knob on the volume control so you don't need a screwdriver to adjust it.

Surprisingly, the Microcom was the only modem we tested that allowed errors to pass in the noise torture tests. While most modems just dropped the line when the noise level got too high, the Microcom actually introduced errors into the data.

The Microcom AX/9624c is a fair performer overall, but its poor performance on noise tests, confusing documentation, and problems in hanging up make it less than stellar.—Howard Marks

RACAL-VADIC
Racal-Vadic 9600VP

Racal-Vadic has a long and well-deserved reputation for making rugged and innovative modems. Its 3434 was the first full-duplex 1,200-bit-per-second modem available for dial-up applications. It even beat AT&T's Bell 212 to market by several months. But it wasn't clear until lower-cost 212-compatible models became available that the 212 "standard" would really become established.

Once again, with no clear standard in place, Racal-Vadic has taken an innovative approach to solving the problem at hand. Rather than build a ping-pong

The Racal-Vadic 9600VP has a low-profile cabinet and a slanted, easy-to-read display with LEDs in its answer buttons. Cooling vents are located toward the back.

asymmetrical modem, Racal-Vadic decided to have its $995 9600VP drop into 1,200-bps mode when there was data to be sent in both directions. Racal-Vadic uses the widely available Rockwell V.29 modem module in the less noise-sensitive 253-millisecond standard mode. It manages to do so without making the modem unusable in interactive applications. Racal-Vadic calls this unique mode of operation "Dynamic Duplex."

In real-world use, the 9600VP felt like a 1,200-bps modem when used in interactive applications. While this wasn't nearly as nice as using one of the true V.32 modems, it was better than some of the slower asymmetrical or ping-pong types. Dynamic Duplex would work better on a modem that could drop down to 2,400 bps than it does on the 9600VP, which drops all the way down to 1,200 bps. In our line-noise tests, the Racal-Vadic managed to get good throughput.

Racal-Vadic then turned its attention to error correction. The result is a modified version of the public domain MNP Class 3 protocol that resends only those blocks that have data errors. Racal-Vadic's resulting "Superset MNP" protocol should give better throughput on noisy lines, since MNP also resends all the blocks sent after the data block that contains the error.

NO COMPRESSION Unfortunately, Racal-Vadic didn't include data compression. This puts the 9600VP at a disadvantage when compared with the other peaked-out-full-duplex modems. 9600VP users can partially make up for this by compressing files with readily available utilities like ARC and PKARC or by using a communications program like *HyperAccess*, which performs its own compression.

In addition to the Hayes AT command set, the 9600VP also supports Racal-Vadic's own auto-dial commands and can store up to 15 telephone numbers. In Vadic mode you can even link stored numbers so

the modem will dial number 13 if there is no answer to a call to number 2. You can't mix commands from the two command sets, so flags—like clear-to-send (CTS) handling or auto-answer on—set in Vadic mode remain set in AT mode. You can even enter Vadic mode commands from the ten-button front panel. This could come in handy for people with dumb terminals, but PC software usually makes these features superfluous.

The 9600VP's low-profile cabinet includes LEDs for transmitted and received data, error correction, high speed, clear to send (CTS), data set ready (DSR), data terminal ready (DTR), ring indicator, and carrier detect in addition to the front-panel switches. The LED in the answer button displays the modem's auto-answer status. Racal-Vadic has also realized that computer people use power strips, so its designers put a cord on both sides of the line transformer so it would take up one outlet.

Even though the 9600VP has been on the market for some time, Racal-Vadic sent us an early production model for testing. Current production units, unlike our sample, may not have the wire-wrap wire and chips with pins in the air. However, the 9600VP's manual showed no rough spots. A rarity in modem manuals, the 9600VP's is technically complete and readable. It even includes a few words on using the 9600VP with PCs and popular PC communications packages including Crosstalk, Carbon Copy, and Close-Up.

Even with Dynamic Duplex and Superset MNP, the 9600VP is only a fair performer when compared with the rest of this group. Perhaps the promised 9600PA with 2,400-bps Dynamic Duplex and data compression will be better.—**Howard Marks**

TELEBIT CORP.
TrailBlazer Plus

With its TrailBlazer, Telebit Corp. offered one of the first high-speed modems in the PC market. The TrailBlazer Plus is the company's attempt to hold its place in the fast lane of telecommunications.

The original TrailBlazer was notable for both its quick file-transfer time and its slow character-turnaround time. Now two generations later, the Telebit TrailBlazer Plus has all but eliminated the old cumber-

some turnaround problem.

During character-turnaround tests, the modem managed 122 milliseconds—making it second only to the Hayes Smartmodem among non-V.32 modems. In actual use, if you type fast enough, you can see

Sticking to a straightforward design, Telebit's TrailBlazer Plus has a black pebbled casing with only an LED display to one side of the front panel.

the screen falling one or two characters behind your typing, then catching up in bursts. This lag, however, is not slow enough to be a problem.

The modem's file-transfer time is still noteworthy. Part of the "Plus," in fact, is a newly added data-compression scheme, which Telebit claims can compress text files as much as 1.6 to 1.

On PC Labs tests over a clean line, the TrailBlazer Plus managed the fastest time of any modem tested. But while its 1,538-character-per-second speed is only slightly faster than that of Ven-Tel's Pathfinder, be aware that Ven-Tel uses the same protocol as the TrailBlazer (having licensed it from Telebit). The next fastest modem is the Courier HST, at 1,248 cps. Not so incidentally, the TrailBlazer and the Pathfinder are the only two modems from different manufacturers that can talk to one another at high speeds.

MISLEADING TEST RESULTS The figures for the Xmodem and Mixed tests are, unfortunately, misleading. To begin,

the TrailBlazer has special modes for Xmodem and Ymodem, and for Kermit transfers. When the modems are set for the appropriate protocol, each modem sends its local computer the acknowledgments required by the software before going to the next packet.

■ Be aware that the TrailBlazer is not fully Hayes-compatible. Its extended commands have little in common with those of the current Hayes Smartmodems.

In effect, the high-speed modems use Xmodem, Ymodem, or Kermit protocol between modem and computer—but they use their own proprietary protocol between modems.

For the protocol support to work, both modems must be set properly before establishing communications. We had to ignore this feature because at PC Labs tests there was no way to stop the file transfers and reset the modems.

Alas, the TrailBlazer also does not hold up over noisy lines. While the modem maintained respectable speeds in all cases where it worked, it gave up completely when faced with an above-average amount of noise on a worse-than-average line. More importantly, there were conditions under which all but one other modem continued to work.

This result was surprising, since the TrailBlazer monitors line conditions and adjusts transmission speed to accommodate changes in conditions. The fall-back/fall-forward scheme is supposed to adjust speed in increments of 100 bits per second at a time.

Interestingly enough, Ven-Tel's Pathfinder—the TrailBlazer's licensed cousin—maintained its speed far better on the noisy lines.

NOT FULLY HAYES-COMPATIBLE

Be aware that the TrailBlazer is not fully Hayes-compatible. Like the Hayes Smartmodem 9600, it stores all settings in nonvolatile memory. But its extended commands have little in common with those of the current Hayes Smartmodems; instead, the TrailBlazer uses a superset of the original Hayes commands. A useful discussion of the differences between the TrailBlazer and the Smartmodem 1200 can be found in the installation guide.

During tests, the TrailBlazer had no problems with Crosstalk XVI or Crosstalk Mk.4, once carrier detect (CD) and data terminal ready (DTR) were set as required by these programs. It wouldn't work with Relay Gold installed for the Hayes Smartmodem 2400, but it had no problems with the program installed for a Smartmodem 1200. (Relay Gold also has a setting for the TrailBlazer.) In addition, it would not work properly with Smartcom II or III.

One thing the TrailBlazer does share with the Hayes Smartmodem 9600 is its speed of negotiations. Establishing a link with another TrailBlazer took roughly 12 seconds—enough that you may need to adjust your communications program so that it won't time-out.

In addition to using its high-speed mode, the TrailBlazer can communicate with other modems at 300 bps using Bell 103 protocol, 1,200 bps with Bell 212 and V.22 protocol, and 2,400 bps with V.22 bis. At low speeds (2,400 bps and below), the TrailBlazer offers support for MNP Classes 1 through 3.

Selling for $1,345, the TrailBlazer offers an acceptable mix of features and performance for the price. But based on PC Labs noise tests, it's a hard one to recommend over the slightly slower Ven-Tel Pathfinder. Under most conditions, the Telebit TrailBlazer should perform well. On marginal lines, it may run into problems.—M. David Stone

UNIVERSAL DATA SYSTEMS
UDS V.32

When V.32 modems parade into the PC marketplace in a big way, the UDS V.32 is likely to be leading the way. The least expensive V.32 modem reviewed here by far, this $1,595 unit approaches the price

of the proprietary high-speed modems.

The modem's physical design alone leaves little doubt about how the company would like to sell this modem. Measuring 9½ inches wide by 11 deep by 3 high, the UDS V.32 is large by PC standards but notably small by data processing standards. What's more, the two-tone gray and off-white colors match your PC or AT exactly, giving the look of a shrunk-down, distant cousin. Put it on top of your PC, and the UDS V.32 will look right at home.

More important, the modem's claim to a place in the PC market is hardly a superficial one. Of all the V.32 modems reviewed here, the UDS modem is the only one that makes a serious attempt at Hayes compatibility.

SOME INCOMPATIBILITY
Early models provided for review had some minor incompatibilities with the Hayes Smartmodems—primarily in default settings that differed from Hayes's. According to UDS, these problems have been fixed, and the version being shipped at this writing is fully compatible with the Smartmodem 2400. (If you received the early version, you can get a free upgrade.)

The claim of full compatibility isn't strictly true, but where there are differences, they make good sense. The Smartmodem's AT B command, for instance, chooses between V.22 protocol and Bell 212 protocol at 1,200 bits per second. This isn't an issue for the UDS modem, which

Universal Data Systems' UDS V.32 has a two-line alphanumeric LCD, three push buttons, and six LEDs on its front panel. There is one cooling vent toward the back.

only uses V.32 protocol and only operates at 4,800 and 9,600 bps. For the UDS modem, the AT B command chooses between 9600-Trellis-coded, 9600-uncoded, or 4800-uncoded modes.

One potentially more troublesome incompatibility, however minor, is the need to resort to front-panel buttons to switch from a voice call to a data call. With the Hayes Smartmodem, you simply type ATA on one side and ATD on the other. With the UDS modem, you have to push the Talk/Data button on the front panel. As one measure of UDS's commitment to the Hayes command set, I was assured that even this incompatibility will be fixed in the firmware's next revision.

As a practical matter, the UDS is compatible enough for most programs—though you'll have to adjust your software's time limit for dialing. (It takes 23 seconds to establish a link after the modem picks up the phone.) The UDS V.32 worked without problems with ProComm, Crosstalk Mk.4, Relay Gold, and Crosstalk XVI, but I could not get it to work with Smartcom III's auto-dial feature.

CHANGEABLE SETTINGS As with the Smartmodem, all settings for the UDS V.32 are held in nonvolatile memory and can be changed through the AT commands. For those who prefer talking directly to the modem, the UDS also offers control through its front panel.

The panel includes a two-line, 16-character LCD, which provides an interactive menu for changing modem settings. Two buttons allow you to move through the menu and change settings as needed. When not displaying the menu, the LCD shows the modem status: idle, talk (the phone can be used), training (negotiating a link with another modem), and on-line (the link is established).

The front panel also features six status lights, plus the equivalent of four more that you can optionally show on the LCD. Badly missing is an auto-answer light—the only serious design oversight in this unit.

The user manual is good by any standards, which is extraordinary for a class of modem that is usually sold to the data processing market. But it does have its gaps. Although the manual does a good job of explaining how to use the modem, it gives almost no background information. A typical example shows the message "Far end echo Level=___dB" and explains it as "Displays the largest far end echo level detected." Here again, UDS is aware of the problem and is planning to revise the manual to make it more appropriate for the PC market.

On the PC Labs tests, there wasn't much to distinguish one V.32 modem from another. Where there were differences, however, the UDS V.32 was the best in each case—with a slightly faster character-turnaround time and slightly faster transmission in Xmodem. On the noise tests, the UDS performed just like all the other V.32 modems, unaffected by everything that we could throw at it.

Clearly, there is much to like about this modem and not much to dislike. It is less expensive than other V.32 modems, performs equally well or better, and is far better suited to the PC market. And although the lack of data compression makes it slower than some nonstandard modems, its V.32 protocol does a better job at surviving poor line conditions. If you're in the market for a full-fledged, full-duplex V.32 modem, there is no reason to look any further.—M. David Stone

U.S. ROBOTICS INC.
Courier HST

U.S. Robotics has long had a history of trying to outdo Hayes by offering modems that promise just a few more features at a somewhat lower price. The Courier HST, which sells for $995, continues this noble tradition.

Like most high-speed modems, the Courier HST uses its own combination of data compression (MNP Class 5), error checking (a modified version of MNP), and modulation protocols. In this case, it uses an asymmetric scheme whereby data flows in one direction at 9,600 bps per second and in the other at 300 bps. The modems automatically switch the high-speed data direction as needed.

And as is typical of high-speed modems, the Courier HST can't talk to anyone else's modem at high speeds. However, it can still talk to other modems at 300 bps with Bell 103 protocol, 1,200 bps with

The LED display on the U.S. Robotics Courier HST covers almost the entire front panel. One large row of cooling vents stretches across the top. DIP-switch settings are printed on the bottom.

Bell 212, or at 2,400 bps with V.22 bis, which covers the most common possibilities. In addition, V.22 protocol at 1,200 bps is expected to have been added by the time you read this.

On performance and features, the Courier HST is intriguingly close to the Hayes Smartmodem—slightly better in some ways, slightly worse in others. The Courier, for example, takes about 6 seconds to establish a connection—about half the time it takes the Smartmodem. But the Smartmodem has the quicker character-turnaround time—just over half the time of the Courier. In each case, the added time of the slower modem is not enough to be a problem, but it is enough of a difference to be noticeable.

SPEED TESTING On the PC Labs Character Turnaround test, the Courier HST scored near the bottom of all modems tested, 84 ms. slower than the Hayes Smartmodem and 150 ms. slower than the leader, the Gandalf Access Series V.32. On the Xmodem test the Courier HST fared about average, about of four other modems. But then, none of these modems is designed to be used with the Xmodem or the Ymodem protocols.

The Courier's performance on the noise tests was also noteworthy. On relatively noise-free lines, the Courier did better than any other modem tested. With average

noise levels, it still ranked among the best. Interestingly, with noisier-than-average lines the Courier gave up, under conditions where some other modems—including the Hayes—could still maintain a connection.

This last result comes as a surprise, because the Courier has a fallback capability intended to help it maintain a connection on poor-quality lines. According to the manual, the modems monitor the quality of the line during 9,600-bps communica-

tions, and they are able to automatically downshift first to 7,200, then 4,800 if needed. If the line improves, the modems automatically shift up to the next higher speed. In our tests, the modem dropped the connection entirely.

The Courier HST uses DIP switches to control some of its settings—the single bank of ten switches being easily reachable on the back of the unit. Be aware that the Courier's DIP switches control some settings that the Hayes Smartmodem controls through software. If you don't know your way around terms like DTR (data terminal ready) and CD (carrier detect), you may have some trouble setting up the Courier HST with your favorite program.

SETTINGS MARKED For users who feel comfortable with DIP switches, a nice touch is that the settings are clearly shown on the bottom of the modem, along with a list of all the modem commands. This ensures that you'll be able to change your modem settings long after you misplace your manual and quick-reference card.

For Hayes compatibility, the product is better than some modems, but it's not perfect. In addition to using DIP switches, the Courier has a substantially different set of extended commands than does the Hayes Smartmodem family. Although there is some overlap, there is far more that is different.

During tests, the Courier managed nicely with *Crosstalk XVI*, *Relay Gold*, and *Crosstalk Mk.4*—but not until after the DIP switches were set for CD and DTR. The modem also did not work properly with *Smartcom II's* or *Smartcom III's* auto-dial functions.

One other consideration for those who busy themselves downloading from bulletin boards: U.S. Robotics is actively targeting BBSs as a market, selling the modem to sysops at a discount. And indeed, on the lists we've seen at PC, there are many more BBSs using the Courier HST than any other high-speed modem.

Certainly, the Courier HST manages respectable performance at an attractive price. Though it wasn't the best performer on PC Labs tests, its combination of price, performance, and predominance on bulletin boards may well be enough to sway your decision.—**M. David Stone**

VEN-TEL INC.
Pathfinder 18K

Ven-Tel's Pathfinder 18K was one of the fastest modems in our test group—especially when sending less-compressible data patterns like archive (.ARC) files. The Pathfinder uses the unique multicarrier PEP (Packetized Ensemble Protocol) technology developed by Telebit for their TrailBlazer modems. Ven-Tel has licensed this technology from Telebit. As a result, TrailBlazer and Pathfinder modems can exchange data at their full speed of almost 18,000 bits per second on a clean line.

The Pathfinder's multicarrier technology allows it to make the most of the telephone network's limited bandwidth. Since each carrier transmits only 200 characters per second, the Pathfinder can fall back in 200-cps increments rather than the more usual fallback from 9,600 to 7,200 bps and 4,800 bps. On PC Labs tests, it began to lose performance as lines became noisier, but it continued to send when all the others gave up.

The PEP protocol is inherently half-duplex, but the Pathfinder's 68000 processor and buffers make its full-duplex emulation perfectly acceptable. When calling bulletin boards, I didn't have the pauses in data transmission and the long echo delay that I had with other half-duplex modems. However, the Pathfinder does take a while to connect as the two modems negotiate which features and carriers to use. The ne-

Ven-Tel's Pathfinder 18K has a conventional design in an aluminum casing. Its front panel has several LEDs—including some bicolor ones that can glow either red or green.

gotiation process is accompanied by a cacophony of beeps and squacks since the speaker disconnects from the phone line at the end of the process. One SysOp that uses the TrailBlazer calls it a "bug zapper" since the negotiation tones sound just like one. Calling a Pathfinder with a low-speed modem takes an especially long time because the Pathfinder tries to make a high-speed connection before attempting a low-speed connection. If you will have both high- and low-speed callers, make sure the low-speed callers set up their systems to handle the long connect time, or they may give up just as the connection is being made.

COMFORTABLE FIT The Pathfinder is significantly smaller than the TrailBlazer. Its aluminum case fits comfortably under a standard desk telephone. Its front panel contains several LEDs—including some bicolor LEDs that can glow either red or green. These bicolor LEDs are covered with clear windows that from the wrong angle make them appear lit even when they are not. Ven-Tel has shown great wisdom in supplying the Pathfinder with a transformer that has cables for both the modem and AC sides of its connections. PC users rarely have room on their power strips for those huge combination plug-transformers and would willingly pay an additional $2 for a transformer with a cord.

Besides the PEP high-speed protocol, the Pathfinder supports the 300-bps Bell 103 and the 1,200-bps Bell 212, as well as the CCITT V.22 and the CCITT 2,400-bps V.22 bis protocols for lower-speed communications. MNP Class 4 is supplied for communications in any of the low-speed protocols.

One unique feature of the Pathfinder (and Telebit's TrailBlazer Plus) is its ability to imitate protocols normally used with communications software while still using its own, more-efficient error-correction scheme between the two modems. When using this protocol, your PC will send data to the Pathfinder using the Xmodem, Kermit, or UUCP (UNIX-to-UNIX Communications Protocol) protocol. Then the modem will respond to the computer as if it were the other end of the communications link. At the same time, the modem strips

> ■ One unique feature of the Pathfinder is its ability to imitate protocols normally used with communications software while still using its own scheme.

off the protocol overhead and sends the data across the phone line using its own error-correction scheme.

At the other end, the other modem builds Xmodem packets and sends them to its computer. This method ensures computer-to-computer error checking—not just for the modem-to-modem link. It also avoids the additional overhead of running two error-correction protocols at the same time. This speed improvement can be significant; you'll find the method especially handy if you're using the Kermit 8th-bit quoting feature for communications with mainframe computers.

The Pathfinder supports the basic Hayes AT command set, but many of the extended AT&T commands are not supported. Those functions are supplied via additional S registers. Ven-Tel is clearly targeting the PC market with this modem, and the readable manual includes directions on using the Pathfinder with popular communications software such as *Crosstalk XVI*.

The Pathfinder is a quality product and should be considered for any point-to-point communications need. On the other hand, it seems unlikely that Telebit technology will become the industry standard, so users looking for long-term public high-speed communications might want to pass it by.—**Howard Marks**   📶

Howard Marks is an independent systems consultant and free-lance writer based in New Jersey. M. David Stone is a contributing editor of PC Magazine.

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PROJECT DATABASE 3

RELATIONAL DATABASES: TAKING THE MIDDLE GROUND

■

Straight relational databases are in a market squeeze, threatened by more-powerful flat-files and a growing number of easy-to-use programmable databases.

Relational database programs—which might better be called "multifile database programs"—have taken over the great middle ground of the PC DBMS software market.

Even among those users whose needs can be met with single-file (or flat-file) database programs like the 24 products reviewed in the previous issue of *PC Magazine*, the comparatively powerful, flexible, and difficult-to-use relational programs are in wide use.

At the same time, the PC database software market has clearly fragmented these relational products into two categories: (1) those that, by including a programming language, allow construction of complex systems, linking many steps, often under menu shells written for those systems in this programming language; and (2) those that, by personal computer standards, are unquestionably relational yet do not offer a programming language and thus provide

less flexibility and tool-making potential. The latter, however, may instead offer such rewards as speed, economy, and ease of use.

So we have divided relational database programs into those two groups—with and without integral programming languages. In this issue you'll find reviews of nine PC DBMS programs sans language; in the next issue look for reviews of 43 more relational databases, all with their own programming languages.

MULTIFILE RELATIONALITY Few terms in the personal computer lexicon are so widely misused as the word *relational*, and few PC topics are so widely misunderstood as the idea of *relationality* in database programs. Indeed, those of us who develop, sell, program in, and use relational databases on PCs use the term very differently than do those working in the minicomputer and mainframe worlds.

Among PC users, *relational database* has come to mean "a database that can draw information from more than one file at a time."

Thus, when Wayne Ratliff wrote the pioneering *Vulcan* while working at Caltech's Jet Propulsion Lab, then helped turn it into one of the best-selling PC hits of all time—as Ashton-Tate's *dBASE II*, then *dBASE III*—the program was tagged as "relational" because (in the *dBASE II* version) it could gather data from a munificent two files at a time. That may be *barely* relational, but relational it is, in the PC definition of the term.

And when Wayne Erickson wrote *RIM (Relational Information Management)* to tackle problems with Boeing's heat-shield tiles on space shuttles, then founded Microrim and published for PC users another big hit product called *R:base* (based on *RIM*), it was called "relational," too, since it could draw information from many files.

In the big-iron world of minis and mainframes, relational means a lot more than merely access to data in multiple files. (See the sidebar "Beyond 'Nextness' and Trickiness.") But whether or not PC database programs meet the tests for relationality applied to products developed for larger computers, the ability to open and use data from several files at once to answer a user's query, or print a report, is an immensely powerful idea.

And that idea has come to lie at the heart of PC database management.

CLOSE "RELATIONS" The means used to link, or relate, the data in those several files gives rise to the term *relational*.

Imagine all the data in each file forming a table, with column headings for categories of information and each row consisting of the information available in those categories for an entry in the file. Now imagine that we create "relations" among those tables—shared information that allows us to associate table 1 with table 2, table 2 with table 3, and so on.

That, in PC terms, is a relational database.

When we turn to the database to answer a query—for example, "What was the date electricity was connected to the house at 1104 Maple Street? Who is responsible for paying the utility bills for that address and how can he be reached? And what is the current balance due on the account?"—the DBMS program uses these relations to search successively through several files, gather the necessary information, and present it on-screen or in a printed report.

One file might be a customer-names-and-addresses file, one might be a history-of-service-by-address file, and one might be an accounts receivable file. The customer file and history-of-service files might be linked by the common relation, or field, *street address*, and the customer file and the accounts receivable file might be linked by the common relation *customer number*—but there might be no common relation between the history-of-service file and the accounts receivable file, because the DBMS program would connect them through the first two links.

DBMS WILDERNESS? In examining the division of relational DBMS programs for PCs into those with and without integral programming languages, it's striking how many of the best-known and most-widely-used relational database programs have, or have lately added, programming languages. In a way, our middle group of DBMS programs without programming languages may be on its way to becoming a no-man's-land, a kind of database wilderness.

It's being squeezed from below by so-phisticated single-file DBMS programs such as *RapidFile*, *Q&A*, and *PFS:Professional File*, which increasingly include such big-time data management features as data typing and verification.

If the greatest benefit of these relational programs in the middle is seen as ease of use, they're also being squeezed hard from above—by such easy-to-use products as *Paradox*. And if their advantage is supposed to be lower cost, they're also being challenged by the various "dCLONES," or *dBASE*-compatibles, such as *dBXL*, which are often priced much lower than these programs yet positioned solidly in the highest-functionality group.

Those considering one of these products might thus want to wait and peruse the entries in our third and last installment of Project Database before making a choice.

None of which is to say there aren't some exceptionally good programs in this middle group.

DBMS POWER *PowerBase*, for example, has been an Editor's Choice in previous Project Database comparisons and remains an exceptional program. In lieu of a programming language, it offers exceptional ease of use and a wonderful "datazoom" feature that lets users move immediately from any field on a screen to the underlying linked data. It's possible to create two-way Zooms between files, and even to Zoom up to ten levels deep—then back out.

That's how those users new to computers thought they were *supposed* to work; it's a "gee whiz!" feature that endlessly delights users in its simplicity and directness. It also demonstrates why savvy database users might well choose a program from among this group, rather than one of the better-known titles in the programmable-relational group.

So why isn't *PowerBase* better known?

Formerly published by PowerBase Systems, the program languished for a while during a critical period of growth and development in the PC database market. For a long time, for example, *PowerBase* didn't support the subdirectories and PATHing added to MS-DOS in DOS 2.0. That developmental lethargy gave other, perhaps less-capable programs a head start.

Eventually acquired by Compuware, a respected Detroit-based vendor of mainframe software, *PowerBase* has been substantially updated and is once again getting the kind of support that it and its users have deserved. It remains one of the best-designed, most-usable database programs available.

PEACE, LOVE, AND DATA *Sequitur* (a text-oriented database, and for that reason not reviewed here) is another old-timer that has continued to stay alive and grow in the face of the avalanche of advertising and publicity for better-known products like *dBASE* and *R:base*. It was godfathered by Lee Felsenstein (also principal designer of the Osborne computer) and a handful of others in Berkeley's Community Memory Project during the heyday of the (Comput-

BEYOND "NEXTNESS" AND TRICKINESS

Thoughts on "relationality" from a founding father.

Our sloppy use of the term *relational* pains Ted Codd. And well it might. For what Dr. Edgar F. Codd—ex-IBM Institute and chief scientist of Codd and Date International, an eminent consulting firm—wrought with his "Relational Model" was nothing less than a revolution in how we think about storing and managing data on computers.

And it involves a lot more than just being able to dip into two or more data files to get answers to our queries. Before Codd's pioneering paper in *Communications of the ACM* (June 1970), large-scale databases were organized according to the hierarchical or network models. That paper, capping 30 years' work at IBM for Codd, won him the prestigious Turing Award in 1981. More importantly, since that publication of Codd's relational model, the trend for computers of all sizes overwhelmingly has been toward products more or less relational.

Unfortunately, Codd would say, it's been *less* rather than *more*.

Codd kicked up a lot of dust in computer science circles 2 years ago, when he codified (sorry) his views on what it takes for a database program to qualify as truly relational into a series of 12 rules, published as a long and difficult piece in *Computerworld*. Setting out all 12 rules in detail would require a lengthy book—a book in fact now being finished by Codd, and due out from Addison-Wesley this fall. But if pressed, Codd will emphasize two areas where today's database products typically fail to meet his criteria.

The first echoes the mathematician's "operational closure" rule. In arithmetic, for example, if an operator operates on numbers, what you get back are . . . numbers. Not oranges or Chevrolets or asteroids, but *numbers*. By the same token, Codd insists, when a database operator (command) operates on a table—and the concept of all data represented as two-dimensional tables is central to the relational model—what you should get back is a table.

Not, as some programs produce, something different from and fundamentally less powerful than the tables in which the data is stored.

Codd argues that very often when we turn to a database with a query, we don't know yet exactly what it is that we want to know. "When we extract data from a database, we often don't know what's there, and so we function like a detective," Codd says. "We ask questions which lead to other questions. Much like the detective, we don't know what we're after 'til we get some leads."

Thus the process of querying the database and getting an answer should help us see what it is we really need. It should also provide what by necessity are only intermediate answers in the form of new tables, upon which we can once again perform an operation. Otherwise, programs return lifeless answers: if the answers are not what we may now realize we were seeking, they cannot be used as the basis for further, more-precise inquiries.

For more formally, every command in a truly relational system takes relations as operands, and produces relations.

Codd also argues for the importance of the structure of those tables in which data is stored by a truly relational pro-

gram. Those tables must have no duplicate information (indeed, in a relational database passing Codd's tests, no data is ever duplicated); we must be able to reorder rows at will, without affecting the data's integrity; and likewise, we must be able to shuffle column headings without losing data.

To build tables that function otherwise, Codd argues, relies on the concept of "nextness," or a specific order to the rows or columns of data—that is, which row (read: record) of data comes next, and which next after that, and which next after *that*—an inherent flaw in every database designed before the relational model. Getting away from what Ted Codd likes to call "tricky ways" of handling data—such as ordering rows—is at the heart of the relational idea.

The relational model, after all, is intended to produce a uniform interface that everyone from data administrator to data clerk to corporate executive can readily understand and use. Needing to know about and deal with structural variations built around "nextness" destroys that consistency and ease of use.

Despite his years at IBM and the company's recognition of his contributions, Codd gives IBM—and virtually every other DBMS vendor—poor grades for fully adopting the relational model in current products. In Part 2 of this exploration of Codd's work and model, which will appear in the next issue, we'll look at how he evaluates many of the better-known database programs, from mainframes to PCs.

A hint: that big best-seller you're thinking of doesn't fare very well.

—**Jim Seymour**

er) Power to the People movement.

The Community Memory project grew out of a desire by Felsenstein and his cohorts to diffuse the power of the computer widely through society. With Berkeley as a rich and fecund testing ground, the plan was to distribute terminals throughout neighborhoods, so Everyman might tap the power of centrally stored databases. The focus on terminals and shared logic was soon overrun by the rapid advance of the powerful, freestanding personal computer, and today, when we look back, the populist zeal of those Bay Area hobbyists and crusaders may seem quaint to some.

But no one who looks at *Sequitur* can fail to respect the exceptional work done by Community Memory in developing the

program. Felsenstein likes to joke that the product was named *Sequitur* so that when innocents asked "Why that name?" he and his colleagues could exclaim, "Because that means all the others are *non sequiturs*!"

Whatever the inspiration for the name, the product remains interesting, a bit quirky, and very powerful.

SQUEEZED IN THE MIDDLE Perhaps your database management needs can be handled with one of the higher-end flat-file programs reviewed in the previous issue, in the first part of Project Database. Perhaps they can only be met with the power and flexibility of one of the programmable relational products coming up in the next issue.

But although the relational programs without integral languages hold an ever-shrinking middle ground between those groups, don't write them off too soon.

For example, WordPerfect Corp.'s new *DataPerfect* (which was scheduled to be released late in January, after press time), has powerful links to the company's top-selling word processing program, *WordPerfect*, which make mail list management a snap. *DataPerfect* will be most useful to those using *WordPerfect*, but that includes a lot of people.

At best, new introductions to this market are bringing unique solutions to business problems. If nothing else, the programs reviewed here are *survivors*.

—**Jim Seymour**

Jim Seymour is a contributing editor of PC Magazine.

Cornerstone

Infocom has packed a respectable number of features into its $99.95 relational database, *Cornerstone*, Version 5.21. While it can't compete with high-end packages, the program certainly has an edge in the low-price market, where most products have no relational capability.

As you might expect from a vendor that has made its mark with interactive fiction, Infocom has provided a very attractive user interface for this program, combining menus with a command line. You create a string of commands either by typing the

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first few letters of each command and pressing the Spacebar to fill in the rest automatically, or by selecting commands from a menu just below the command line.

At each stage, you're prompted for the next command; a new menu then presents your available options. If the command string must include the name of a file, field, or set of saved criteria, the menu will present you with all the appropriate names you've created.

To make things even easier, there's

context-sensitive help that incorporates the names of your files and fields into its messages. An excellent interactive on-line tutorial will help the novice user get started.

The documentation is quite good. Although it neglects to provide instructions for making the program self-booting from a floppy disk, you will probably want to run it from a hard disk (as with most databases). An AT is also advisable for *Cornerstone*, since it's a sluggish performer on an 8088-based PC. Even screen scrolling and cursor movement are agonizingly slow on the less-powerful machine.
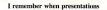
Cornerstone provides a good range of options for data entry. There's automatic range testing, and you can specify default values, mandatory fill, and unique entries. The program understands such entries as Today, Next Monday, and Last Month and will convert each of them to the appropriate date. You can also specify a list of values from which you must select to fill a particular field; you can then type only the first few letters of the value and have *Cornerstone* automatically fill in the rest. If you've forgotten which values you will, pressing F5 will show you your options.

Another nice feature lets you designate a field as a subrecord, which can contain a number of subfields. Creating subrecords within a file can provide an easier alternative to creating two separate files and linking them relationally.

For the sake of simplicity, *Cornerstone* relies heavily on on-screen forms. To select records, you enter your selection criteria after the appropriate field names in a blank form. Using AND or OR specifications, you can link several forms to perform Boolean operations.

If you wish to change the way your data is displayed, you're presented with another blank form representing a record. You can then use the cursor to move fields around on the form or change their display lengths, hide field names, and add fixed text. And for later use, you can save numerous different display format or selection forms.

FILE LINKING AND REPORTING
Cornerstone is somewhat limited in its relational capabilities. You can view or generate a report on only one file at time. If you wish to view or use information from

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one file in the context of another, you must link the files, create some new fields in the first file, and then specify that the values in these fields are to be derived from fields in the second file. On the positive side, you have a good assortment of math, financial, time, and date functions at your disposal for deriving values from different fields.

In other areas, too, Cornerstone often forces you to go about things in very awkward ways. If, for example, you decide to transfer last year's records from your active file to a new file, you're in for a cumbersome process. You must select the records you wish to move, save the selection criteria, export the file to ASCII format using the saved criteria, import it under the new filename, and then delete the redundant records from the original file.

To perform a global update on a text field, you must select all the records containing the string you want changed, assign the replacement string as a default value for the field you want to update, and then issue a recompute command.

Cornerstone has fairly limited reporting capabilities. To define a report, you must select the records you want, sort them, define the display format, then calculate totals and subtotals—each time waiting for one procedure to finish before beginning the next. You can save report criteria for later use, but you must store selection criteria separately from the other elements.

This is not a program for handling very large databases, although it can process files containing up to 32,700 records. After watching Cornerstone devote 3 hours to importing a 30,000-record ASCII file and nearly half an hour to sorting it, we gave up on running the remaining PC Labs tests on the largest file size.

If you need to generate complex reports or work with huge numbers of records, Cornerstone is no substitute for a high-end relational database. If your needs are more modest, however, and speed isn't a primary concern, you would do well to consider Cornerstone for its elegant user interface and its impressive array of data entry options. It would certainly prove a more powerful alternative to many flat file programs that are priced significantly higher.
—Robert Kendall

Enrich

Enrich, Migent Software's nonprogrammable database manager, is described by its vendor as "the business applications generator." While the temptation may be to call it a forms generator, in reality the product's true value lies somewhere between those extremes. It is a very good forms generator. But its lack of a procedural language precludes its classification as an applications generator.

The market Migent claims to be targeting is the small-business end user, and the structure of the product and its documentation work well toward that end, if small business also means small application. The profile of this purchaser would involve limited exposure to DOS or other packages, a forms approach to a given problem, and limited application complexity. The buyer who fits this profile will be satisfied with Enrich and, with very little effort, will be able to create an input form and corresponding database.

Migent never lost sight of its intended market when designing the Enrich manuals. The documentation is lean, concise, and logically arranged—as far as it goes. The "Read This First" packet neatly orients and directs the reader to the rest of the documentation, and it also serves as an installation manual. There are three other booklets: Tutorial, Reference Guide, and Applications Manual.

The Tutorial walks the user through the form/database development process, taking a step back to cover some basic hardware/DOS concepts. Lessons cover topics starting with the creation of a form/database, proceeding with revising and reporting on a form, and then moving on to more-advanced topics like sharing information among several forms and doing calculations based upon situations and conditions.

There are some shortcomings in the Reference Manual. It does not have its own index, but instead is referred to in the Tutorial index. The examples supplied for the middling to advanced topics are not sufficient, and the procedures are unclear. This lack of depth will be frustrating for any user who decides to venture beyond simple applications.

What's worse, we experienced a lot of trouble getting help from the technical support staff at Migent. To be unable to perform fairly simple tasks because help is unavailable in any form soured our impressions of what might be an outstanding product in its class—it is hard to judge a function you cannot perform.

The third booklet, which has its own floppy disk, is the Applications sampler. If you find forms that are similar to the ones you need, the sampler will be particularly helpful; otherwise, it is useful as an adjunct to the tutorial.

There are other elements in Enrich designed with the end user in mind. The on-

MULTIPLE DATABASES AT A GLANCE

If you wish to alter the format for displaying your records, Cornerstone presents you with a form to edit. To change the position of the selected field (indicated in reverse video), you move the cursor to the new location and press Enter.

Files & Folders' help screen includes an explanation of the current menu and a description of each available function.

Enrich's sample report for merchandise return allows implementation of averaging and record counts as well as some date functions. The H and F in the left column stand for header and footer material; D stands for detail.

Goldatabase's Manage Database screen is where all the action is, including adding, modifying, searching, and printing records.

You can temporarily sort on all of the fields in your Nutshell Plus database. You can then undo the sort quickly with menu commands or save it permanently by exporting the data to a new file.

line help is context sensitive and refers the user to specific manuals and pages for more information. The menu-driven, screen-painting approach in this package is also suitable for its intended user.

FORMS AND FUNCTIONS   It is easy to create and modify forms on the screen. First you lay out the prompts and the fields, along with any borders you want. You can further define the fields, including the type of information they hold (character, date, numeric, or dollar), the origin or source of the fields' data, which file should be updated by the information entered into the field, the appearance (intensity, underline, blink), patterning (such as a phone-number convention), and other miscellaneous field characteristics.

There are some other nifty things that *Enrich* will do, such as changing the screen characteristics of a field depending on the value of that field. If, for instance, you want the data entry person to be aware of a negative balance upon retrieving the record of a particular client, you can set up the form to show the field in a reverse-blink mode if the value is less than zero.

There is also a windowing function that allows you to work with several forms at once. The system assigns field names internally and then allows you to refer to them, change them, or not use them at all, simply pointing to a field during any field definition function.

One glaring limitation is the lack of a browse or zoom function; unless you prepare a report, the only way to view the data in your files is one at a time. Also, within the reporting function there is no simple way of automatically including all the fields in a particular form. The absence of these two factors makes viewing more than one record at a time a cumbersome chore. This is not in keeping with an otherwise clearly defined strategy of making *Enrich* a tool for the unsophisticated end user.

Another unreasonable limitation: *Enrich* will not allow you to sort on a number field in descending order. At some point in most users' relationship with the package, this refusal is bound to frustrate.

Enrich's lack of any programming capability precludes the development of a complicated application, but the product was not designed with that use in mind. As a low-priced tool for the low-key end user, it is a valuable, easy-to-master tool. If you expect your needs to grow beyond the basics, however, *Enrich* will be a source of disappointment.   —Kate Emery

Files & Folders

Looking for an inexpensive database program with a slick user interface—one that's powerful and fast, has relational capabilities, and has been around long enough to prove its worth in the marketplace? If so, take a good look at *Files & Folders*, Version 1.17, from Starcom Computer Corp. In a nutshell, *F & F* is an intelligent, electronic filing cabinet. It is not programmable, but it offers some powerful data validation, math, and relational functions as well as password protection at the file level.

To install *F & F* on a hard disk, copy the Program disk and, optionally, the Tutorial disk to the hard drive. The first time *F & F* starts up, it prompts you for the type of monitor you'll be using and the location of the key disk (if needed). The copy-protected version uses the Program disk as a key disk, which has to be in Drive A or B; whenever you start up the program. For an additional $35, the copy-protected *F & F* can be exchanged for a non-copy-protected version, provided your registration card has been sent in.

F & F comes with an on-disk tutorial as well as a "Getting Started" tutorial section in the manual; both tutorials give a clear understanding of the program's basic functions. The on-disk tutorial can be run interactively or automatically as a demo.

All *F & F* commands and menus are accessed via function keys F1 through F8, with a different menu displayed at the bottom of the screen for each level of the program. During program execution, keys that aren't used for the current menu choice are disabled—a nice touch for novice computer users and those of us who make a habit of pressing the wrong keys.

F8 invokes one of many context-sensitive help screens. These explain the overall function of the current menu and briefly define each selection available from this menu. A page number supplied on each help screen cross-references the manual. And for additional help, Starcom offers unlimited free technical support to all *F & F* users. However, there is no toll-free number.

PROGRAM PROCEDURES   Data files in *F & F* are set up in "folders" that contain "boxes" (fields) and "labels" (field prompts). Each folder contains one data file, and up to 30 folders can exist in one "cabinet" (directory).

F & F uses the concept of "picture programming," whereby all the fields for a data file are painted on a data entry screen. Setting up a database definition is easy. Boxes, representing fields, are placed on the entry screen, given names, and assigned data types. Math equations can be set up for numeric fields, and text addition equations (concatenation) can be performed on text fields. *F & F* lets you test the equations with sample data before saving them in the folder definition.

Sort-key fields (indexes) can be created for each field while you are defining the database structure. These fields provide a fast and efficient method of searching for records and are also used to link separate databases. *F & F* sets up a binary tree for each sort-key field, so, unlike index files in

FACT FILE

Files & Folders, Version 1.17
Starcom Computer Corp.
22121 17th Ave. SE
Olympic Bldg. #110
Bothell, WA 98021
(206) 486-6464

List Price: Copy-protected version, $295; non-copy-protected version, $35 extra, plus registration.

Requires: 256K RAM, two floppy disk drives or hard disk drive, IBM PC or compatible, DOS 2.0 or later.

In Short: This is an inexpensive relational database with a flashy user interface, powerful data validation and math functions, and flexible reporting capabilities. Binary sort trees allow fast and efficient retrieval of data, but they can lead to limitations in database size and importing speed. Copy-protected (non-copy-protected version available).

CIRCLE **684** ON READER SERVICE CARD

PC MAGAZINE — Relational Databases: Summary of Features
(Products listed in ascending price order)

	Cornerstone $99.95	Goldelebase $149.95	Superbase $149.95 (with GEM) $99.95 (without GEM)	Enrish $199.00	Xirive $245.00 (plus $245.00 for Btrieve)	Files & Folders $295.00	Nutshell Plus $295.00	PowerBase $349.00	Universal base Sis $395.00
PROGRAM SIZE									
Installed program size (kilobytes)	242	654	166	166	1,694	349	425	13,000	818
Min. no. of program files	2	2	3	1	8	3	1	25	2
FILE STRUCTURE LIMITS									
Size of a 5,000-record file (kilobytes)	694	570	1,050	1,050	745	349	1,050	990	624
Fields per record	4,000	80	255	200	256	78	Unlimited	80	80
Fields per record	158	300	300	300	256	125	Unlimited	64	Unlimited
Fields per database	18,960	300	Unlimited	3,600	256	375	Unlimited	Unlimited	Unlimited
Record size (bytes)	3,800	16,000	Unlimited	4,096	Unlimited	1,404	Unlimited	1,600	Unlimited
Records per data file	32,700	Unlimited	Unlimited	Unlimited	Unlimited	65,000	Unlimited	65,534	Unlimited
No. of data files per database	120	Unlimited	999	12	Unlimited	3	Unlimited	64	Unlimited
DATA FIELD TYPES AND MAXIMUM SIZES									
Character fields	(255 bytes)	(80 bytes)	(255 bytes)	(200 bytes)	(1 byte)	(78 bytes)	(Unlimited)	(80 bytes)	(80 bytes)
Long text fields	(4,000 bytes)	○	○	○	○	○	(Unlimited)	○	○
Numeric fields	(255 bytes)	(16 bytes)	(13 bytes)	(15 bytes)	(13 bytes)	(78 bytes)	(100 bytes)	(15 bytes)	(80 bytes)
Currency fields	(255 bytes)	○	(13 bytes)	(15 bytes)	(2 bytes)	○	○	(17 bytes)	○
Date fields	(255 bytes)	(8 bytes)	(6 bytes)	(2 bytes)	(4 bytes)	(8 bytes)	(10 bytes)	(8 bytes)	(8 bytes)
Time fields	(255 bytes)	(10 bytes)	○	(2 bytes)	(4 bytes)	(8 bytes)	○	(8 bytes)	○
Boolean fields	(255 bytes)	○	(6 bytes)	○	(1 byte)	(4 bytes)	○	(3 bytes)	○
Other fields	○	○	(7K bytes)	○	○	(78 bytes)	(250 bytes)	○	(80 bytes)
DATA FIELD ATTRIBUTES									
Tests for valid data ranges	○ (automatic)	●	(user-defined)	(user-defined)	○	●	○	(user-defined)	(user-defined)
Provides default values	●	●	●	●	○	○	○	●	●
Checks for specific values	(user-defined)	●	(user-defined)	(user-defined)	○	●	○	(automatic)	(user-defined)
Verifies data via a lookup table	●	●	●	●	○	○	○	●	●
Provides automatic data entry from lookup table	●	●	●	●	○	(user-defined)	(user-defined)	●	●
Double-entry verification	○	○	○	○	○	○	○	●	○
Requires all fields to be filled	●	●	●	(user-defined)	○	●	○	●	●
Offers "forced uppercase" option	●	●	● (user-defined)	(user-defined)	○	●	○	● (user-defined)	●
Converts date formats	● (automatic)	●	● (user-defined)	○	○	●	○	●	● (automatic)
Increments fields	●	●	●	●	○	●	○	●	●
Unique fields	● (user-defined)	●	● (automatic)	●	○	●	○	●	●
Fixed values for data entry fields	● (user-defined)	●	● (automatic)	●	○	●	●	●	●
Calculated fields on entry screen	●	●	●	●	●	●	●	●	●
Carryover from previous record	●	●	○	●	○	●	○	●	●
Error handling	● (automatic)	●	● (automatic)	● (automatic)	●	● (automatic)	●	● (automatic)	● (automatic)
Data dictionary/catalog	● (user-defined)	●	● (user-defined)	● (user-defined)	○	● (automatic)	●	● (automatic)	● (automatic)

▲—Indicates Editor's Choice   ● — Yes   ○ — No   N/A—Not applicable program does not have this feature

	Cornerstone $99.95	Goldelsbase $149.95	Superbase $149.95 (with GEM), $99.95 (without GEM)	Enrich $199.00	Xtrieve $245.00 (plus $245.00 for Xtrieve)	Files & Folders $295.00	Nutshell Plus $295.00	PowerBase $349.00	Universel base Sis $395.00
DATA IMPORT EXPORT									
DIF	●	●	●	○	●	●	○	●	○
DBF	●	●	○	●	●	○	●	●	●
PFS	●	●	○	○	○	○	○	○	●
SDF	●	●	●	●	●	○	●	○	○
SYLK	○	○	○	○	○	○	○	○	○
WKS	●	○	○	●	●	●	●	○	●
ASCII	○	●	●	●	●	●	●	●	●
User-defined	●	●	●	●	○	●	●	●	●
DATA MANIPULATION									
Max. no. of indexing fields	Unlimited	20	Unlimited	23	20	25	Unlimited	6	5
Max. no. of compound indexes	None	80	None	5	20	78	Unlimited	None	15
Unique index value	○	●	○	●	○	○	●	○	●
Respecify indexed fields	●	●	●	●	○	●	●	●	●
Automatic index maintenance	●	●	○	●	●	●	●	●	●
Respecify file definition	●	●	●	●	●	●	●	●	●
Multiple record deletions	●	●	●	●	●	○	●	●	●
Multiple record updates	●	●	●	●	●	○	●	●	●
Math updates	○	●	●	●	●	○	○	●	●
Text updates	●	●	●	●	○	●	○	●	●
No. of view tables	1	None	None	None	255	None	Unlimited	None	Unlimited
No. of join tables	None	None	None	None	8	None	None	10	Unlimited
No. of union tables	None	None	None	None	None	None	None	None	Unlimited
No. of append tables	None	None	None	None	None	2	1	2	Unlimited
Max. no. of open data files	8	1	5	12	None	3	1	10	12
SORTING									
Permanent	○	○	●	●	○	●	●	●	●
Temporary (for duration of command)	●	●	●	●	●	●	○	●	●
Sorts on any field	●	●	●	●	●	○	●	●	●
Sorts on indexed field only	○	●	○	○	●	○	●	○	○
No. of fields sorted at once	Unlimited	20	Unlimited	5	20	78	Unlimited	N/A*	5
SEARCH PARAMETERS									
First occurrences	○	●	●	○	●	●	●	●	●
All occurrences	●	●	●	●	●	●	●	●	●
Multiple fields (max. no.)	●	● (Unlimited)	● (Unlimited)	● (Unlimited)	● (20)	○	●	● (300 characters)	● (65)
Case-sensitive	○	●	●	○	●	○	●	●	○
Whole word	○	●	●	○	○	○	○	●	●
Value or character range	●	●	●	●	●	●	●	●	●
Wildcard or string segment	●	●	●	●	●	●	○	●	●
Null character search	●	●	●	○	○	●	○	●	○
Boolean	●	●	●	●	●	●	●	●	●
Compound Boolean	●	○	●	●	○	●	●	●	●

▲ = Indicates Editor's Choice ● = Yes ○ = No N/A = Not applicable program does not have this feature

Relational Databases: Summary of Features
(Products listed in ascending price order)

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QUERY FACILITIES									
Query by example	○	○	○	○	○	○	○	●	●
Query by forms	●	●	●	●	●	●	●	●	●
Multiple file access	●	○	●	●	●	●	○	●	●
Query editor support	●	●	●	●	●	●	●	●	●
Stored queries	●	●	●	●	●	○	○	●	●
MATHEMATICAL FUNCTIONS									
Data arithmetic	●	●	●	●	○	●	●	●	●
Time arithmetic	●	●	●	●	○	●	●	●	●
Arithmetic functions	●	●	●	●	○	●	●	●	●
Exponential functions	●	●	●	●	○	●	●	●	●
Trigonometric functions	○	○	●	○	○	○	○	○	○
Financial functions	○	○	●	○	○	○	○	○	○
Aggregate functions									
Totals	●	●	●	●	●	●	●	●	●
Subtotals	●	●	●	●	●	●	●	●	●
Average	●	●	●	●	●	●	●	●	●
Count	●	●	●	●	●	●	●	●	●
Maximum	●	●	●	●	●	●	●	●	●
Minimum	●	●	●	●	●	●	●	●	●
Other	○	●	○	○	○	○	○	○	●
STATISTICS									
Standard deviation	●	○	●	○	○	○	○	○	○
Variance	●	○	●	○	○	○	○	○	○
COMMAND STRATEGY									
Static menus	●	●	●	●	○	●	●	●	●
Dynamic menus	●	●	●	○	○	○	●	●	●
Typed commands	●	●	●	●	●	●	●	●	●
Support menus	●	●	●	○	●	●	●	●	●
MACROS									
Automatic recording	○	○	○	●	○	○	●	○	○
Keystroke macro	○	○	●	●	○	●	●	○	○
Macro language	○	○	●	●	○	○	●	○	○
INPUT FACILITIES									
No. of screens per file	1	10	Unlimited	1	1	1	Unlimited	1	Unlimited
No. of titles per screen	1	1	1	12	8	3	1	1	12
Screen definition									
Painting	●	●	●	●	●	●	●	●	●
Coordinates specification	○	○	●	○	○	○	○	●	●
Automatic field-name placement	●	●	●	●	○	●	●	●	●

▲—indicates Editor's Choice   ● — Yes   ○— No   N/A—Not applicable; program does not have this feature

Now that there's an IRMA
put your old ideas about m

PC Coordinators have been debating the viability of Macintosh™-to-mainframe links for a couple of years now. With opinions varying from impeccable to impossible.

But no matter what ideas you might have on the subject, they are now old ideas.
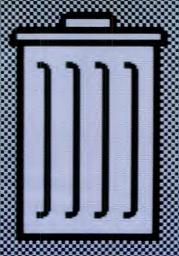
Because DCA has introduced MacIRMA.™ And all the reliability and ease of use that

made IRMA™ the PC-to-mainframe industry standard has come to the Macintosh II™ and Macintosh SE™

How does that help you? Well, MacIRMA can support the DCA and IBM™ mainframe file transfer software that you probably already have installed in TSO, CMS and CICS environments. Allowing you to actually offer

many other database programs, the sort keys are always maintained. You must be sure, however, to create all your sort keys when you set up your database; otherwise, you'll have to revise the folder and transfer all the records from the old copy to the new copy in order to build a new sort key (binary tree).

Data can be output using a List & Sort command that lets you list any fields and any records, using specified criteria, to a workspace area in RAM. Once the fields are in the workspace, you can add or delete rows; sort the data; add breaks on fields; insert subtotals, totals, and calculations; and print the data to a file or to a printer. But if you're dealing with a large data file and the records won't fit in the workspace, you also can create a customized report. The report writer allows you to include a report header, page headers and footers, up to five levels of breaks, and a report summary. Unlike List & Sort, a report definition can be saved and printed at any time.

Besides single-file functions, F & F provides Remote Folder Functions that allow you to link up to three databases relationally by a common sort key. Remote Folder Functions enable you to search for records in different remote folders and to save data to and from them. Completely automatic, these functions are saved with the database definition—which makes managing a relational system extremely easy, since you don't have to worry about opening other folders for remote updates or even multiple-file lists and reports.

Password security is allowed at the database (folder) level. Users can be given Save, Write, or Revise access to folders.

SIZE AND SPEED F & F is remarkably fast. Of course, the binary-tree sorting method contributes to the speed of data retrieval, but you'll also notice that screen updates are unusually speedy. This is because the program writes directly to video RAM, bypassing DOS along the way. Data is updated in real-time mode, and there are no preliminary steps involved; in other words, what you see on the screen is what's stored in the data file.

A couple of things to watch out for when creating database structures are the size of the sort-key fields and the number of keys. These two factors directly affect the maximum number of records allowed in a folder and the speed with which data can be imported to a folder. The larger the binary tree files are, the fewer records can fit in a database and the slower the records can be read into a folder. If you have between 20 and 25 characters combined in the sort keys, for example, you will be able to enter only between 20,000 and 30,000 records.

F & F is a flexible and easy-to-use relational database manager, with many powerful functions available without the hassle of complicated commands and routines. These benefits make the program ideal for end users and for anyone who wants to stay away from programming.
—Greg Alwang

Goldatabase

Goldatabase, from Golata Computer Services, stands out as a simple-to-use, menu-driven database with some advanced data management features. But several shortcomings, however minor, keep it from proving a leader in its class.

Although *Goldatabase* can be run from floppies, a hard disk is recommended for best performance. Installation is a snap: you simply execute a batch file that copies your program files to the hard disk. To keep things simple, the program doesn't require changes to your CONFIG.SYS file.

Goldatabase merges the creation of the database and that of the data entry screen into one process. At the blank Screen Definition screen, you simply paint your input form as you would like it to appear. By entering certain characters (# = numeric, % = character, and so on), you define the location and the field type. Typing &&&&&&&&, for instance, will create a date field at that location on the input screen.

Goldatabase allows for numeric, integer, character, date, and calculated fields. Since you can have up to ten screens per database, a field can be defined as displayonly in case you want to display the same field at the top of each screen.

To spruce up the data entry screens, *Goldatabase* makes it fairly simple to draw single- and double-lined boxes around part of the screen or all of it, if you like.

Any field you create can be defined as keyed, for fast access, or mandatory (to require a value to be input). You can define further edit criteria to be enforced during data entry, including range checks and list verification. You can also create a lookup verification of a field in another database. Product numbers entered on your sales order screen, for example, could be verified against your inventory file. To perform this verification you must have matching field values (such as product numbers) in each database. It was frustrating, however, to be unable to display data from another database on my current screen without actually adding that data to my current database.

DATA MANAGEMENT The Manage Database module of *Goldatabase* is where the action is. Here you perform your data input, searching, printing, and data exporting. From a command line, you can enter one of 23 commands to perform the operation you desire; to save some typing, the ten most commonly used commands are available through the function keys.

Goldatabase displays the command associated with each function key on the last line of the display. As you are learning the commands, you may want to use the program's help function: type F1 and you'll see a point-and-shoot type menu of all the available commands. As you select a

Benchmark Tests:
Relational Databases

Relational databases are expected to be more robust than their flat-file counterparts. They should be able to handle larger files and be more sophisticated in the way they go about it. For this reason, PC Labs developed a suite of tests to measure their strength while manipulating a 50,000-record file. None of the programs reviewed here, however, could perform those tests. The programs either were unable to import the 50,000-record file within the allotted 3 hours or, once the file was imported, were unable to perform any other tests within the 3 hours allotted for each. In fact, Xtrieve took almost 8 hours to import the 50,000-record test file, and Nutshell Plus took more than 10 hours.

In examining the results reported here (for tests on smaller files), you should consider that good programming in a relational database should result in a product that manipulates records more quickly as the size of the data file increases. A given test should not take 10 times as long to process 5,000 records as it takes for 500 records. Cornerstone, for example, performed well on the Delete and Index test, where it took no more time with 5,000 records than with 500 records. But on the same test, Universal base Six 285 times as long to process the 5,000-record file as it did for the 500-record file.

The Import test measures how quickly the database can import an ASCII file (of either fixed-field length or comma-delimited format) with an index on the text field. We included the indexing portion of the test to avoid penalizing programs that automatically index the first field during the data conversion. Some programs required a two-step process for the test: an import followed by indexing.

The Extract test measures the time it takes the program to extract two fields from the database and send them to a RAMdisk or to the screen. As part of the procedure, the DBMS was also required to sort on one of the fields and select fields that matched one specified criterion. We output the file to a RAMdisk or to the screen to eliminate printer performance as a factor in the timed results.

The Sort test measures the time it takes for the package to sort the files on an unindexed field in ascending order.

The Two-Table Report test generates a report for those records whose "year" field is equal to 1988 or 1989. The report is made up of 10 fields and is sorted (in ascending and descending order) on 2 of these fields. The test calculates a subtotal and a total at each breakpoint and a grand total at the end of the report. The resulting file is sent to a RAMdisk.

The Search test measures the time it takes to locate the first record that satisfies two criteria (make = Fendix and model = coupe).
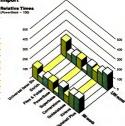
The Text Update test measures the time necessary to search for and replace a specified text field.

The Delete and Index test measures the time required to remove two columns (Units and SellPrice) from a Product table created by this task, and then to reindex the file.

The Pack/Rebuild test reflects the time spent regaining disk space lost during the Delete and Index test and rebuilding the index keys. Some programs automatically pack and rebuild the database after deleting and indexing; for these programs, no results are listed.
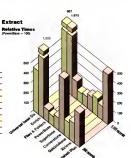
The Project Sales Table test measures the time taken to project four fields—Tran ..., No., Units, SellPrice, and TranDate—from the test database into a new table or database, and then to index the first field. Some prices were listed as $0.00; only those records for which the SellPrice was greater than that amount were projected.

Import

Relative Times
(PowerBase = 100)

Performance Times
(Times given in seconds)

	Import	
	500 records	**5,000 records**
Universal base Six	163.70	2,363.23
Enrich	84.00	880.00
Files & Folders	131.70	1,343.00
PowerBase	140.00	1,510.00
Superbase	42.90	414.00
Cornerstone	180.00	*1,699.00
Geldatabase	115.00	1,490.00
Xtrieve	190.34	1,965.72
Nutshell Plus	199.20	2,390.00

(continues)

**Benchmark Tests:
Relational Databases**

Extract

Relative Times
(PowerBase = 100)

Performance Times	Extract	
(Times given in seconds)	500 records	5,000 records
Universal base Six	47.96	829.35
Enrich	166.00	1,657.00
Files & Folders	13.40	153.00
PowerBase	11.00	84.00
Superbase	14.08	94.00
Cornerstone	62.00	123.00
Goldstbase	16.00	148.00
Xtrieve	21.70	115.31
Notshell Plus	37.30	422.30

Sort

Relative Times
(PowerBase = 100)

Performance Times	Sort	
(Times given in seconds)	500 records	5,000 records
Universal base Six	101.51	1,511.61
Enrich	84.00	880.40
Files & Folders	64.80	742.00
PowerBase	84.00	642.00
Superbase	30.22	304.00
Cornerstone	21.00	226.00
Goldstbase	20.00	446.00
Xtrieve	18.67	194.65
Notshell Plus	13.10	150.40
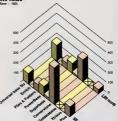
Two-Table Report

Relative Times
(PowerBase = 100)
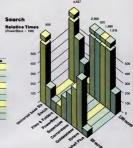
Performance Times	Two-Table Report	
(Times given in seconds)	**500 records**	**5,000 records**
Universal base Six	60.72	1,011.43
Enrich	N/A*	N/A*
Files & Folders	40.30	387.00
PowerBase	57.00	643.00
Superbase	14.70	124.00
Cornerstone	210.00	1,407.00
Goldstabse	N/A†	N/A†
Xtrieve	N/A†	N/A†
Nutshell Plus	57.80	289.75

N/A*—Not applicable: program was unable to complete this test within the allotted time
N/A†—Not applicable: program does not have this feature

Search

Relative Times
(PowerBase = 100)

Performance Times	Search	
(Times given in seconds)	**500 records**	**5,000 records**
Universal base Six	17.12	241.84
Enrich	4.00	23.00
Files & Folders	2.00	12.80
PowerBase	2.00	5.00
Superbase	4.50	115.00
Cornerstone	6.00	46.00
Goldstabse	8.00	74.00
Xtrieve	10.72	95.93
Nutshell Plus	1.20	10.20
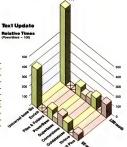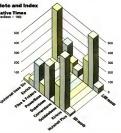
(continue)

Benchmark Tests:
Relational Databases

Text Update

Relative Times
(PowerBase = 100)

Performance Times (Times given in seconds)	Text Update	
	500 records	5,000 records
Universal base Six	53.81	896.18
Enrich	N/A[2]	N/A[2]
Files & Folders	N/A[2]	N/A[2]
PowerBase	14.00	116.00
Superbase	7.20	60.00
Cornerstone	17.00	77.00
Goldatabase	13.00	132.00
Xtrieve	N/A[2]	N/A[2]
Nutshell Plus	8.30	151.70

N/A[2]— Not applicable: program does not have this feature.

Delete and Index

Relative Times
(PowerBase = 100)

Performance Times (Times given in seconds)	Delete and Index	
	500 records	5,000 records
Universal base Six	10.48	2,994.79
Enrich	33.00	256.00
Files & Folders	139.00	1,417.00
PowerBase	53.00	582.00
Superbase	180.00	361.00
Cornerstone	8.00	8.00
Goldatabase	114.00	1,424.00
Xtrieve	289.90	3,061.44
Nutshell Plus	10.60	290.00

Pack/Rebuild

Relative Times
(PowerBase - 100)
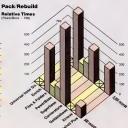
Performance Times	Pack/Rebuild	
(Times given in seconds)	500 records	5,000 records
Universal base Six	N/A†	N/A†
Enrich	N/A‡	N/A‡
Files & Folders	57.00	622.00
PowerBase	13.00	110.00
Superbase	17.30	168.00
Cornerstone	100.00	352.00
Goldelebase	N/A‡	N/A‡
Xtrieve	N/A‡	N/A‡
Nutshell Plus	13.87	297.20

N/A†—Not applicable; program was unable to complete this test within the allotted time.
N/A‡—Not applicable: program does not have this feature.
N/A‡—Not applicable: rebuild is an automatic function, not a timeable command-based function

Project Sales Table

Relative Times
(PowerBase - 100)

Performance Times	Project Sales Table	
(Times given in seconds)	500 records	5,000 records
Universal base Six	102.26	1,666.42
Enrich	N/A†	N/A†
Files & Folders	37.90	375.00
PowerBase	87.00	911.00
Superbase	20.71	299.00
Cornerstone	98.00	873.00
Goldelebase	N/A†	N/A†
Xtrieve	115.15	825.72
Nutshell Plus	N/A†	N/A†

N/A†—Not applicable; program does not have this feature.

(end)

■ **RELATIONAL DATABASES**

menu choice, the help function walks you through the options available for that command.

Searching for information in the database can be performed in two ways. For novices, *Goldatabase* provides a query-by-forms option, much like that of *PFS:File*. For experienced users, a Find command can be entered on the command line. Each search method can perform equal-to, less-than and greater-than queries as well as substring searches using the Contains option.

Compound searches using the Find command are performed in multiple steps. For example, to search a database for "name = Smith AND city = Boston," you would enter a Find command that searches for *Smith*. *Goldatabase* creates a selection set consisting of only those records found in the search. Your second Find command will search only the records found in the selection set—not the entire database. Though the actual retrieval time is impressive with this method, you do spend additional time entering two Find commands instead of one.

REPORT CREATION Creating reports in *Goldatabase* is virtually painless. Like the input screens, reports are created by painting the image of a report on the screen. Fields included on the report can be from the current database or "mapped" in from another database. Unfortunately, you are not able to perform any calculations on fields mapped from secondary databases. Reports can be outputted to the screen, printer, or text file. Much to my frustration, however, I was unable to freeze output being sent to the screen. (Even Ctrl-S didn't work!)

In addition to the report function, *Goldatabase* provides a form module where you can quickly design forms for output. This facility is extremely useful for creating form letters with fields from your database inserted into the proper locations. One problem lies in the editor provided for creating your letter, which contains few basic word processing capabilities such as word wrap. For more-graphically-oriented forms, you can draw boxes around sections of text or include other graphics in the document.

The documentation is short and

sweet—perhaps too short. *Goldatabase* uses very few examples and practically no screen layouts or graphics to assist in explaining functions. A tutorial disk walks the new user through the basic database functions.

Goldatabase is for users who do not want to spend a lifetime learning a complex database. For $149.95, *Goldatabase* contains a lot of functionality for your dollar. If you can live with some minor shortcomings, you're likely to be pleased. —T.J. White

Nutshell Plus

Nutshell Plus is the latest addition to Nashoba Systems' line of relational databases. But it's more than just an enhancement of *Nutshell*—*Nutshell Plus* packs quite a few features of its own into a small package.

Nutshell Plus is shipped with a program disk, utilities disk, and a tutorial. You can run it from the program disk, or you can create a subdirectory and copy the floppy disks onto your hard disk. The hands-on tutorial gives you a good overview of the package.

In the first screen, the program requests the name of a file to open; only one file can be open at a time. Once you've entered the name, *Nutshell Plus* moves to the working screen, which has two lines at the top for status information and two at the bottom

DATASHIELD... YOUR FIRST LINE OF PROTECTION

■ RELATIONAL DATABASES

for commands, menus, and messages. The rest of the screen serves as a work area.

Much as in *Lotus 1-2-3*, menus are arranged in tiers. You use them in one of two ways: you can use an Alt-key and the first letter of the choice, or you can type F2, select the choice with Tab or cursor keys, and hit Return to execute the command. An escape at any menu level returns you to the next higher level.

You set up your entry fields using the Define command and specifying the field name along with one of five field types. Besides dates, numbers, and text fields, you can create calculation fields or summary fields that total one field for the entire database. You can also assign verification ranges, lists, and limits to any field. When the definitions are complete, *Nutshell Plus* creates an entry screen for adding and changing records with the Add and Modify functions. The Tab key moves you from field to field, and F10 or the big Plus key saves your records.

The power of *Nutshell Plus* lies in its ability to create and modify screen and report layouts easily. You can quickly add a field to a screen layout with the Include function, change the description, and move the field around the screen with cursor keys. Each field can be linked to fields in another file, allowing you to verify data as you enter it. You can place text anywhere on the screen and move smoothly from one layout to the next.

Report layouts can include fields from the current database or linked files along with subtotals and grand totals. You can also create headers and footers with report titles, dates, times, and page numbers. *Nutshell Plus* supports 35 printers, and you can send predefined codes for normal and compressed output.

DATA MANIPULATION To limit the database to certain records, you use the Find command to select the records using the active screen layout form. Entering formulas such as ">100" in the layout fields has the program display or print only the items matching the expressions. You can enter multiple expressions, and you can use multiple layouts to select "OR" conditions. The Find All function clears the condition, restoring all the records in the database.

The Sort function lets you temporarily reorder the file on any fields in the database. You select each field and indicate whether to sort in ascending or descending order; the program then displays and prints records in the current sort order until you select the Unsort function. You can save the sort permanently by exporting the file to a new *Nutshell Plus* file.

Nutshell Plus can import and export .DIF, delimited ASCII, or *dBASE II* files, and other *Nutshell Plus* files. An included utility program compresses inactive files and recovers damaged *Nutshell Plus* files. In addition, a macro capability captures keystrokes and assigns them to function keys or Ctrl-, Alt-, or Shift-key sequences.

The documentation is clearly written, well indexed, and very helpful. The introduction explains *Nutshell Plus*'s approach to databases well, and the manual contains many examples of screens and methods for using each function. The on-screen help messages are succinct but clear, and they show the page reference in the manual for each subject displayed.

Although *Nutshell Plus* is a dramatic improvement over prior versions, it could still use a few changes. *dBASE II* was superseded a while ago by *dBASE III*, yet *Nutshell Plus* still imports and exports only *dBASE II* files. While it's nice not having to specify field lengths, the automatic screen layouts overdefine the entry area, requiring modifications to clean them up. All in all, there's nothing seriously wrong that couldn't be fixed in a future version.

Nutshell Plus does grow on you, and you can perform sophisticated tasks if you spend some time using it. It doesn't outshine its competitors with fancy functions and graphical interfaces. It just does well what it says it does. —**Mike Falkner**

PowerBase

Database management system users often have to choose between ugly, difficult, powerful programs and pretty, easy, weak ones. Compuware Corp's *PowerBase*, Version 2.3, is a user's program with many advanced features that lets you start with simple files and then get fancier when you need to, without ever having to write a line of program code.

Like most feature-laden programs,

PowerBase can run on a machine with two floppy disk drives but is much more convenient when stored on and run from a hard disk. To install the program on a hard disk, you boot the machine with DOS, insert one of the five distribution disks in drive A:, and type "a:install". After answering a few simple questions, you just sit back and insert disks as prompted. Depending on your configuration, the in-

■ RELATIONAL DATABASES

stalled program takes between 1.4MB and 1.8MB of hard disk space.

All operations in *PowerBase* are controlled either by selecting function options from horizontal bar menus or by using a command mode. In the latter, you select functions by typing one or two letters from the keyboard, entering just enough letters to differentiate the desired command from others available at the time.

Setting up files in *PowerBase* is fairly straightforward, the only difference from the norm being that you can specify prompt-only or value-only fields if your application calls for them. All files are automatically indexed on the first field defined, but you can deselect that field and maintain indexes on up to six fields per file. *PowerBase* does not have a sort feature, but indexing greatly quickens selection and search functions.

The only drawback to creating a new index is the time it takes to index a large file, which can be considerable. Record query takes place with either a prompted Query-by-Example method or an equation mode, which is slightly more difficult but offers more flexibility.

In *PowerBase*, the term *application* refers to a selection of files that can be related to one another. An application can consist of up to 64 files; each can have as many as 64 fields. A given record is limited to 1,600 characters, with a maximum field length of 80 characters. (The vendor suggests that each application be stored in its own subdirectory.) Three predefined applications are included with the program: an electronic phone directory, a stock-tracking system, and an invoice-tracking application.

POWERFUL FEATURES The greatest "power" in *PowerBase* is its ability to tie files together. While some programs require lengthy and awkward programming to relate one file to another, with *Power-Base* all you have to do is hit the "zoom" key, choose the file to tie in with the list of those available, select a common field, and you're done. After that point, any time you want to use information stored in separate but related files, calling for the necessary fields is a simple matter of pointing and shooting.

Another nice feature among *Power-*

Base's basic database functions is that you can change file structures at will without jeopardizing data. So if you decide that you need two additional fields in a file after it has already been set up and contains thousands of records, the process is easy and safe: once you complete the file redefinition, the old data is automatically transferred to the new structure.

The program's Powerlinks feature is used to import and export files from other programs. *PowerBase* can read file structures created by *dBASE II* and *III*, *Lotus 1-2-3*, (Releases 1A and 2.x), *MultiPlan*, *VisiCalc*, *Symphony*, *PFS:File*, *Multi-Mate*, *WordPerfect*, and *WordStar*, as well as .DIF and ASCII files. Once a link between data sources has been defined, it can be saved and reused or edited.

PowerBase also allows password protection on the application level. Whenever you start *PowerBase*, you are asked to select an application to work with. If you don't know the password for an application that bears one, you cannot use that application. You can choose not to assign passwords, and you can change or delete them once they have been set up.

PowerBase accommodates users with different levels of previous experience. The *QuickStart* manual and disk that come with the program give a quick overview of its basic features with an interactive demo. Users with little or no computer experience

MULTIPLE DATABASES AT A GLANCE

One of PowerBase's strongest features is its smooth way of tying files together. This process, called PowerZoom, is all menu driven, requiring no programming whatsoever.

This data entry screen in Universal base Six is filled in for a multiple database search on the database. The search facilities are used to find a particular record; the query mode helps in searches that will retrieve groups of records.

This screen highlights Superbase's special "external" file feature. On the left side of the screen are typical data fields; to the right is an image linked to the record. Note the VCR-like controls at the bottom of the screen.

To make full use of Xtrieve's capabilities, it's best to configure a hard disk drive with separate subdirectories for each type of file created. A data dictionary defines files, as shown above, and the main menu's Configure selection helps you customize the locations of particular file types.

should follow the 10-lesson, 184-page Tutorial section in the *PowerBase* user manual. The Tutorial section assumes nothing and is extremely detailed—and even this is divided into levels, offering more practice on specific functions for those who need it but allowing experts to skip ahead to the next topic.

More-experienced users can start with the 29-page Overview section, which summarizes the program design, mechanics, and modules. The 164-page Advanced Topics section of the manual discusses and provides examples of *PowerBase*'s more-powerful features—such as application development; relating (or zooming between) files; linking *PowerBase* to other programs; password protection; and the pro-

gram's command mode.

The manual also includes an alphabetical command-reference section, appendices, a glossary, and a handy cross-referenced index.

Version 2.3 of *PowerBase*, the package available for testing at press time, does not include a "pack" function to throw away records marked for deletion. This feature

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will be available, however, in Version 2.4, due out in early 1988; until then, a utility called PBPACK is available free for downloading by all users from the *Power-Base* Bulletin Board. The bulletin board is

■ *PowerBase*

**accommodates users with
different levels of
previous experience.**

a convenient facility through which users can keep track of patches, changes, and updates, as well as trading hints and tricks for using the program.

Compuware is still improving *Power-Base*. But over the years it has not changed

the program's basic strength: giving users a solid tool for building everything from simple files to fairly sophisticated multiple-file applications, all without a need for programming skills.—**Bruce Brown**

Superbase Personal Relational Database System

Superconductivity, Superman, supersonic, superpower . . . it had to happen. With Britain-based Precision Software's entry into the American database market (distributed by Progressive Peripherals and Software), we now have *Superbase*. Occasionally meriting the superlative, this relatively new product offers easy design, query, and report functions through the use of pop-down menus. Its relational functions are workable. And, like the other database programs that are reviewed in this issue,

Superbase is not programmable.

Upon installation, however, *Superbase* reveals one of its shortcomings: it can only be used in conjunction with a mouse and the GEM windowlike operating environment. If you are unaccustomed to clicking to confirm—and pointing—you may find it disorienting, cumbersome, and slow. For better or worse, you are required to acquaint yourself with GEM before loading the *Superbase* program disk. Six disks, five new subdirectories, and 30 pages of documentation later, you're ready for an introduction to *Superbase*.

Building and using a database is admirably simple in *Superbase*. Field definition is accomplished through a series of dialogs. The elaborate array of choices for data types, sizes, and restrictions (data checking) are logically and visually well presented. The same dialog format is used consistently for virtually all other functions. Making global changes, importing

ASCII files, simple reporting, and querying can all be executed deftly by the new user.

More-experienced users can skip much of the slower dialog process, however, by directly typing commands into a window. Nonetheless, the mouse must still be clicked frequently to confirm commands. Once mastered, the command syntax allows far quicker database designing, editing, and querying. Frequently used dialogs or commands can be saved for later use.

Problems emerge when your demands on the program are more sophisticated. Using relational functions and designing complex reports, although possible, is frustrating. A typical relational function such as joining two files involves oblique keystroke combinations only casually mentioned in the manual. All but the simplest reports involve convoluted steps.

Furthermore, standard reporting features like multiline headers and footers or

introduction and conclusion fields are absent from the report generator. Overall, the program's complexity of use and its uneven documentation hinder the user anxious to make complex reports and relational queries.

The documentation for *Superbase* and GEM consists of a poorly organized and indexed 242-page manual—much of which is filled with needless error commentary. In a discussion of file design, for instance, one sentence reads, "You may not need or want the former, but you are going to have to gain the latter." The absence of on-line help obliges you to return to this manual often, while the brief and incomplete tutorials leave you curious but uninformed. The last resort is a phone call to the vendor's helpful technical support line. Memorize that telephone number!

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mouse interface and the GEM operating environment, the use of VCR-like controls and multiple views (table, record, form) make this package attractive to the first-time user. (Instead of the usual "end of file" and "next record," the program uses "fast forward" and "play" for reviewing records.) The multiple views make it possible to see all the information contained in one record (record view), or just a few fields from many records (table view). At the introductory level, these features go a long way toward making this program a superlative beginner's package.

A facility for including large text files and pictures within databases is provided by a linking field. This special external field makes it possible to include images or full word-processing documents in database records. Though not unique, this feature is a useful innovation seldom found in programs of this type.

Superbase Professional, a more elaborate version of the program, is due out this year. Its distributors say that it will include improved relational functions—plus programmability. In addition, there are plans to improve the documentation and provide on-line help. No doubt, many of the program's better parts will become more accessible with such improvements.

But for now, *Superbase Personal* remains an innovatively designed yet limited relational database program. Users intrigued by GEM and attracted to mice will find this DBMS appropriate. Those who intend to build large or complex relational databases would be best advised to wait for *Superbase Professional* or select another program.—Paul Lang

Universal base Six

While *Universal base Six* is commonly used as a generic database, it is also used as the foundation of vertical market applications. Over half a dozen products from ASAP Inc.—designed for such applications as bar coding, inventory, and stockroom work—now have *Six* at their core. Many owners also use it to generate proprietary applications.

This penchant for using *Six* as an application foundation reflects how simple and straightforward the product is. All its operations are function-key menu driven; its

system prompts are clear and complete. And its "relationalness," though somewhat unusual, is automatic. Any number of files can be tapped for reports or queries without doing formal joins.

Six first reveals its unusual relational nature when you design data entry screens. There are two ways to design a screen—

■ *Six* first reveals its unusual relational nature when you design data entry screens—through the automatic or manual modes.

---

through the automatic or manual modes. In automatic mode, *Six* lists field items down the left side of the screen, with underlined, blank fields adjacent on the right. In manual mode, fields can appear anywhere on the screen, and you can include text to act as prompts.

INDEXING POWER The first data item (or field) on a screen is automatically designated by the program as an index. This field can't be unindexed unless you reshuffle the field order. In addition, you can have up to four secondary indexes on a screen, and up to 15 for the whole database. The secondary indexes can be changed at any time. In essence, each index establishes a data file. And herein lies the power—and the quirkiness—of *Six*.

The indexes are used to link data in a dependency relationship. In a given record, all the fields that follow an index field are dependent on it. If there is more than one index, then each grouping of an index field and its dependent fields is like a subrecord. The secondary indexes can have multiple values for each of the primary index field values. The data in the subrecords can be called up successively or searched, while the data under the primary index stays the same.

For example, a database record might

have Customer Number as the primary index, with address and telephone-number fields under it. Below these fields could be a secondary index, Invoice Number, with fields of transaction data under it. The part of the record starting with Invoice Number would be a subrecord with many sets of values for each Customer Number.

Being able to nest indexes gives you a lot of power, but it can also lead to befuddlement. If your screen organization isn't well thought out, correcting problems can force you to redesign screens completely, export data to a .DIF or ASCII file, and then import it to the new screens—a process you want to avoid.

An index field can also be used in other screens to recall a group of data fields independent on it, and the same link the screens together. Then when it comes to reporting or querying a group of these related files or screens, you only have to specify the fields you want without telling the program what files they are in. This is a much simpler approach than the rigmarole of using file equations or programming statements to create a formal join, as is necessary in many other relational database managers.

Screens don't have to have different primary indexes; if they don't, they are really just other views of the same file. But by creating a number of screen views, you

---

FACT FILE

Universal base Six
ASAP Inc.
1041 41st Ave.
Santa Cruz, CA 95062
(408) 476-3035 (collect calls accepted)
List Price: $395
Requires: 256K RAM, two disk drives (hard disk recommended), DOS 2.0 or later.
In Short: *Universal base Six* is a simple, straightforward program with an unusual approach to being relational. Data fields from different file views or separate files can be linked without doing formal joins. But as a consequence, certain operations become very slow. The program is also an application generator. Not copy protected.
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can update a file in pieces, which is more efficient than "tabbing" through a large number of fields. Whenever a data field is updated, all the screens and files that contain it are automatically updated.

There is one important downside to the relational approach *Six* takes: speed. Large files that are split only into screen views

■ **Novelle's *Xtrieve*, with its companion program *Btrieve*, is targeted toward the sophisticated database applications designer.**

rather than smaller physical subsets can make some operations—such as queries, extracts, and reports—take an inordinately long time. The same goes for groups of files linked together in a complicated net of interdependencies.

ENTRY AND RETRIEVAL Actually creating the screens or manipulating them is very easy because of the prompts in a dialog box at the top of the design screen. Fields contain text, numbers, dates, or money. They can be up to 80 characters in length.

With the screens designed and linked, data entry is just a function key away. In the data entry mode, you can also search the file for particular records. Searches can be for exact occurrences, unknown values (using wildcards), greater than, less than, not equal to, and so on. Because the search criteria are entered directly in the data field, the field has to be large enough to hold the search statement, or else you have to return to screen design and enlarge the field.

Searching is only the first level of data retrieval. By going to the query module in the program, you can view, modify, or delete many records at once. With the query facilities you have the ability to set long, complicated selection criteria using both

the AND and OR Boolean connectors.

The most sophisticated way to retrieve data is through custom reports. Data items in a report can appear in both a free-form area and a columnar area. You can add whatever text you want to the free-form area. But this setup doesn't allow for footers. The items appearing in the report can be selected by certain criteria, can be sorted in ascending or descending order, and can include totals and averages. *Six* produces labels in much the same way it produces reports.

The application-building abilities of *Six*, collectively called the "process control system," let you order the use of menus and job files you have written with the DOS line editor or an outside word processor.

The next version of the program—due out sometime within the first half 1988—will let you run reports right from the data entry area without having to exit to the report area; I saw a beta version of this capability. An ASAP spokesman also said the next version will be about 75 percent faster, a very welcome and needed enhancement.—*Henry Fersko-Weiss*

Xtrieve

Novelle's *Xtrieve*, with its companion program *Btrieve*, is targeted toward the sophisticated database applications designer. Casual users or small-business owners may find it just the ticket for customized applications, but unlocking the power of this package takes time and a fair understanding of DBMS concepts.

Xtrieve, Version 3.02, is a user-interface application that allows for data entry, file import, query, and configuration using familiar overlapping menus so common today. *Btrieve* is the low-level record management software. Included on the disk for *Btrieve*, Version 4.10, are various C, Pascal, and 8088 Assembler source and object files to provide the applications programmer with access to the *Btrieve* record management calls.

Running the single-user version requires an IBM compatible with DOS 2.0 or later, with 256K of memory available after DOS, *Btrieve*, and any other resident programs are loaded. While the system will run on a machine with dual floppy

disk drives, a hard disk is recommended since *Xtrieve* goes to disk often. A hard disk should speed things up; better yet, use a RAMdisk if possible.

Xtrieve comes in the familiar boxed binders and is a snap to install. Make a backup copy and run from the A: drive, with a disk in drive B:, and you are ready to go. The hard disk install is just as simple. Copy the floppy disks to any subdirectory you wish and bring up the system by typing "xtrieve".

To make full use of *Xtrieve*'s capabilities, it makes good sense to configure the hard disk with separate subdirectories for each of the various types of files that the program creates. The locations of particular file types are defined to the system using the Configure selection from the main menu. Configure also allows the definition of colors, keyboard use, and the various switch settings.

A file is defined to *Xtrieve* in the data dictionary; to access this function, select Dictionary from the main menu. Here you can create, show, define, remove, reorganize, and set defaults for your database fields. Be careful not to create a dictionary

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if one already exists, for only one can reside in a subdirectory; instead, select another directory from the dictionary configuration menu.

ARRANGING YOUR DATA
Xtrieve possesses one of the richest sets of data types available in an off-the-shelf package. Augmenting all of the standard types (including time and date fields) are 4- and 8-byte floating-point values, as well as both Pascal- and C-type strings. The unsophisticated user, however, may not understand the issues involved in selecting one type over another. And the program provides little help.

Data may be entered into the database either manually or by importing one of three types of files. To enter data by hand is straightforward: just select Edit from the View menu, and the full range of choices are presented. The Add and Modify options are like a spreadsheet. Position the cursor and type.

To import a data file, you simply select the file type and read it into a predefined View corresponding to the file. The only two standard types of files supported by Xtrieve are .DIF and .SDF formats, but you can also read and write an unformatted file. This feature can be a very handy tool for seasoned users.

After you have defined your database to *Xtrieve* and entered your data, simple analysis is elementary. A View or table is created by selecting View from the main menu. A View would consist of a number of your database fields and user-defined fields. Column headings and field masks can be easily set.

Once your data is in the database, you can query or Restrict your view to a selection criterion. A full range of single and compound Boolean expressions are supported, and restrictions can be saved along with the View for later recall. One major drawback of the Restrict command—and of *Xtrieve* in general—is the lack of any predefined statistical, financial, mathematical, or logical functions.

Files can be Joined together in Views using fields from up to eight files. Functions such as creating a new file based on an intersection, non-intersection, or union are not supported. Once you have narrowed the number of records down to the

desired subset, you can summarize viewed fields. Maximum, minimum, count, and average are supported, and the process to access these functions is simple and direct.

OPTIONAL REPORT PACKAGE
Report Option, formerly called *Rtrieve*, was not provided with the package we reviewed. The *Xtrieve* Print command will print (to the console, printer, or file) all the fields in all the records in the current View. This is not adequate for serious work, however, and I would suggest you buy *Report Option* if you purchase *Xtrieve*.

One major concern for the novice user is the Help function, with which *Xtrieve* does a commendable job. Pressing the standard F1 key quickly activates a full-screen, contextual Help function. And Help can be modified using a supplied utility, a useful feature for small-business applications development.

The documentation is well written but sketchy in places. Good use of examples and screens compensates for the cursory treatment of some topics. A command tree, dictionary structure, glossary, list of error messages, explanation of data types, configuration and customization guide are included in the appendixes.

As may be expected, any command that can be carried out from the menu can be executed from a command file. *Xtrieve* will record a command stream for later replaying; these Novelle chose to implement as macros rather than as a command file in the usual sense. I found this disconcerting at first, but got used to it quickly. Command files can be recorded, or edited with a text editor, and then recompiled. One of the most useful features *Xtrieve* offers the small-business person is its well-defined and implemented security. Database, file, and field access are supported for multiple users. Data encryption is supported within *Btrieve* for the applications developer.

Xtrieve reminds me of soda pop. It tastes good and has a nice package—but when you are finished, the thirst remains. While simple tasks are easy to accomplish, more-advanced projects may require a good deal of programming experience. Novelle has offered us a product that has a smooth user interface and some interesting features. But it lacks several aspects of a DBMS needed by many power users and small-business owners. If you're looking for a basic record management system for some customized applications, however, Novelle may have just what you're looking for.—*Steven P. Williams*

MAKING CONNECTIONS

Two Token-Ring Alternatives

●

Like the market for IBM PC clones, the market for systems compatible with IBM's Token-Ring Network is heating up. Racore and Proteon have come out with two new systems. The former competes on price; the latter corrects some of the Token-Ring's flaws.

FRANK J. DERFLER, JR.

All who compete against Big Blue follow a few basic rules. Their products must be cheaper and/or better. And they must be as IBM compatible as legally possible. The competitors to IBM's Token-Ring Network that we review in this article, Racore's LANpac 802.5 System and Proteon's ProNET-4, do not stray from these tried-and-true rules.

The technology that allows clone makers to produce products that are compatible with IBM's Token-Ring Network is the Texas Instruments TMS380 chip set. This chip set is certified by IBM as compatible both with the Institute of Electrical and Electronic Engineers (IEEE) 802.5 standard and with IBM's own extensions to the IEEE standard.

Compatibility means that the cards from different vendors should be able to operate on the same network with each other and with IBM. This is important because you may want to add cards from other vendors to an existing Token-Ring network (and because IBM's cards are hard to get).

When preparing this article, we therefore tested IBM, Racore, and Proteon products together on the same network. We performed file transfers and accessed files in various ways, including the use of DOS 3.1 byte-range-locking calls. We found no incompatibilities or anomalies, although we can't certify that these products will work together under all conditions. Software sensitive to the internal timing and operation of the IBM network interface cards, particularly anything using IBM's Advanced Program-to-Program Communi-

cations, do not necessarily work with these clone cards. We tried them under the most common operational conditions, and they did work together.

But while this chip set makes cloning practical, the amount of ingenuity that the vendor uses to promote the chip set is what wins or loses buyers. Racore takes on the market through aggressive pricing. Racore's LANpac 802.5 interface card carries a retail price of $495, and its hub costs $395, as compared with $795 for a comparable IBM Token-Ring card. While more expensive than the IBM system at $695 for its interface cards and $895 and $995 for its wiring hubs, Proteon's ProNET-4 adds value by improving on some obvious flaws in the IBM system.

TOKEN-RING DOSSIER

The IBM Token-Ring system is becoming ever more important to corporate Automated Data Processing (ADP) managers because IBM supports an increasing number of Token-Ring interfaces to mainframes. The Token-Ring architecture is an important piece of IBM's Systems Application Architecture (SAA), which is an emerging architecture from IBM that describes how applications should interact with all types of computers. SAA is designed to allow mainframes and PCs to share data on an equal basis on networks. A number of vendors, such as Proteon, also make Token-Ring interface cards for popular minicomputers, allowing for easy interaction between PCs and minis without complex and expensive micro-to-mainframe links and gateways.

IBM representatives took a firm lead in steering the IEEE committee that established the 802.5 standard, which describes the Token-Ring architecture and how a token-passing protocol is used on a network.

The 802.5 standard specifies both the physical and electrical connection scheme for a Token-Ring system. It combines an electrical ring topology, in which every station actively passes information on to the next one in the ring, with a physical hub topology, in which all stations connect to a central wiring hub.

The electrical token-ring access technique uses a single token that circulates among the stations when all are idle. When a station has a message to transmit, it waits

TOKENLINK PLUS: 3COM'S TOKEN-RING ALTERNATIVE

3Com Corp. was the first company to market Token-Ring alternatives using the TI chip set. PC Magazine reviewed 3Com's Token-Ring alternatives in "Making Connections: 3Com's Ethernet and Token-Ring" (April 14, 1987).

The TokenLink Plus, which 3Com uses as its network interface card, uses 16-bit-wide addressing and on-board processing to relieve the communications burden on the server's CPU. We strongly recommend using these powerful 3Com cards (or their Proteon equivalents) in Token-Ring servers if your networking software includes drivers for these adapters. While 3Com does not provide drivers for Novell's NetWare (no surprise), it does provide a NETBIOS interface. 3Com's NETBIOS interface makes the TokenLink cards interchangeable with IBM's Token-Ring cards running under IBM's PC Local Area Net-

work Program or other NETBIOS-compatible operating systems.

The 3Com cards will operate with other 802.5 hardware in the typical physical hub topology. But for 3Com's own Token-Ring system, the company does not clone the IBM wire center or even use a physical hub topology. Instead, it takes the relays out of the wire center and puts them into individual interface boxes near every network node. The interface boxes are connected by a single cable run, a process that saves wire and installation costs since you don't need dedicated runs of wire from each node to the wire-closet.

The 3Com TokenLink cards provide another alternative to using IBM's Token-Ring products in a standard 802.5 LAN, and the 3Com TokenLink physical bus architecture provides a completely different way to install Token-Ring systems.—Frank J. Derfler, Jr.

for a "free" token and changes it to a "busy" token. The station then transmits a block of data called a frame immediately following the busy token. The frame contains all or part of the message the station has to send. The frame makes a complete round-trip to all network stations and is purged by the transmitting station, which then inserts a new free token on the ring. During the round-trip transmission process, no other station may send data over the network.

Physically, the Token-Ring network consists of the network interface card, the hub, and cabling to connect the card and the hub. The IEEE defined the functionality and protocols of these pieces, while IBM designed their form and fit.

With the physical hub topology used in the Token-Ring system, every station is connected to the hub by a dedicated cable run. This topology simplifies troubleshooting and helps keep the network running, because a fault in any single cable doesn't bring down the network. Electro-mechanical relays in the hub bring stations

into the ring as they initialize their network interface cards and remove the stations from the ring when they shut down.

The major software piece of the Token-Ring is the network operating system. Since the IEEE standard stops short of specifying operating system software, you can run a Token-Ring network with any software containing appropriate drivers for the network interface cards. Networking software companies such as Novell and Banyan Systems provide the drivers for IBM's cards, but makers of token-ring clone interface cards must provide their own drivers for popular networking programs. Usually, clone manufacturers will provide one floppy disk with drivers for Novell's NetWare and another containing a version of NETBIOS to allow the cards to run under programs such as Torus's Tapestry and IBM's PC Local Area Network Program, which talk to the networking hardware through standard NETBIOS calls.

Because both Proteon and Racore provided drivers for Novell's Advanced

NetWare, we tested their systems using this operating system.

THE HUB OF ACTIVITY The hub or wire center used in a Token-Ring network, which IBM calls the Multistation Access Unit, is critically important to network operation. It has connectors that give up to eight personal computers or other devices access to the network. The Access Unit fits

■ These products from Proteon and Racore are a response to both the successes and flaws of the IBM system.

into a 19-inch rack and has a special cabinet for desk or wall mounting.

Because the IBM Access Unit is not powered by the wall socket, you must initialize each port with a hand-held battery-powered device—the No. 8228 Setup Aid—when you set up the system. The Setup Aid properly aligns the contacts on all of the relays in the Access Unit.

The 802.5 standard describes special connectors, called "dual-purpose connectors," that can mate a cable with a chassis, such as the wiring hub, or can mate two cables together to extend them.

The central cable hub concept is also used in systems such as AT&T's StarLAN and Standard Microsystems' ARCnet. Unfortunately, the IBM Access Units have no visible indication of network operation like these systems do. For instance, Proteon's ProNET-10's hub has lights that indicate a good electrical connection, while the hub for AT&T's StarLAN and Standard Microsystems' ARCnet have lights that indicate network operation. Though primitive, these indicators are nonetheless useful for troubleshooting network cable and connection problems.

Because the Token-Ring network's electrical ring topology requires every workstation to actively repeat signals, the failure of one station halts network traffic. Under some conditions, network interface cards will self-test and disconnect themselves from the ring if they're malfunctioning. But in other circumstances, if the particular failure of an interface card causes it to stay silently in the ring or to generate improper packets, the network will not function. In these situations, you must physically disconnect the faulty station's cable from the IBM hub to restore operation.

And since many companies store the wiring hub in a closet some distance from the nearest network workstation, network troubleshooting becomes a two-person operation. One crouches in a dark wiring closet disconnecting one cable at a time, while the other watches a workstation screen, waiting for network activity to resume. When the network comes back to life, the watcher tells the wiring closet with cable caused the outage. This routine happens so often that people who maintain IBM networks bitterly joke that their most important troubleshooting tool is a pair of walkie-talkies: one for the person in the wiring closet, and another one for the workstation watcher.

These products from Proteon and Racore are a response to both the successes and flaws of the IBM system. In the reviews that follow, you can see for yourself which is the most attractive system for your application.

PROTEON INC.
ProNET-4

Proteon is a serious player in the high-end local area network business. ProNET-4, which we review here, is Proteon's IEEE 802.5 standard alternative to IBM's Token-Ring Network. In addition, the company offers a proprietary token-passing system, ProNET-10, reviewed in "Making Connections: LANs Under NetWare," *PC Magazine*, December 9, 1986, as well as an ultrareliable fiber-optic system, ProNET-10 p2bx, reviewed in "Making Connections: The Who, Why, and How of Fiber-optic LANs," *PC Magazine*, January 12, 1988.

The ProNET-4 system consists of two kinds of hardware: network interface cards and wiring hubs. It also comes with software that helps with network troubleshooting. You can purchase the hardware either

separately or packaged in various kits. It is in these hubs that Proteon adds value to the standard IBM-type system.

In addition to making the ProNET-4 interface cards for IBM PC- and AT-type computers, Proteon also makes the cards for systems using the Multibus, VMEbus, UniBus, and Q-Bus. The Model p1340 card uses 8-bit I/O for the PC-bus systems. The 8-bit card allows a maximum throughput of 2 megabits per second between the ring and the PC's memory. The Proteon Model p1344 interface system for the 16-bit AT bus has full on-board DMA (direct memory access) for efficient data transfer. This card is normally used in servers in which heavier data transfer loads require the card's maximum 3.5-Mbps ring-to-memory transfer rate. These network interface cards are well designed and can take advantage of the higher-numbered DMA channels in PC AT systems.

You can use these cards on a network with IBM's Token-Ring hardware, but they are not plug-compatible replacements for IBM's cards. Instead, you must install customized drivers for the networking software or use the card manufacturer's NETBIOS. Drivers for ProNET-4's cards are provided with Novell's *Advanced*

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NNOVELL

For network solutions, you should be seeing red.

Proteon's ProNET-4 Topology
(Media: Shielded twisted-pair cable)

Proteon's ProNET-4 system consists of the wire center (the Intelligent Wire Center is shown here), the Proteon p1344 network interface card, TokenVIEW-4 software, and a serial bus interface for the controlling PC. We tested the system running under Novell's Advanced NetWare. Like IBM's Token-Ring Network, Proteon's ProNET-4 system uses a physical star topology, but electrically, the stations on the network are connected in a ring.

NetWare and Banyan's VINES networking software. To install Proteon's network interface cards on either of these operating systems, you simply make a selection on the installation menu. Proteon also supplies software meeting the Department of Defense's Transmission Control Protocol/Internet Protocol (TCP/IP) standards for use in networks of computers with different operating systems.

WIRE CENTER Proteon adds value to its Token-Ring system with its ProNET-4 wire center and unique TokenVIEW-4 software. Together, the processor in the wire center and software running in a PC make network troubleshooting an easy job requiring only one person.

Externally, the ProNET-4 p2700 Multistation Wire Center is nearly identical to the IBM wire center, fitting into the same

Decision Flowchart

Need more than file exchange and peripheral sharing? — yes → ...

File exchange only? — yes → **Disk/cartridge exchange**

Use voice-and-data PBX or Centrex services? — yes →

Data PBX
- Avatar Technologies' Alliance ZSL System
- Digital Products' NetCommander
- Newbridge Networks' 1008MainStreet Data Controller

Patch box

Voice-and-data PBX
- Mitel's SX-200 Digital
- Shared Resource Exchange's System One
- Northern Telecom's Meridian SL-1S
- Siemens Information System's Saturn IIE

Heavy data load?

Large investment in DOS-based personal computers?

Workstation size and security important? — yes →

LANstations
- Corvus Diskless PC Workstation
- Kimtron Satellite Diskless PC-Intelligent Workstation
- NCR 3390 Workstation
- Pure Data LANmark Network Workstation
- Recore PC AT – Compatible Diskless Workstation
- 3Com 3Station

Clustered CPU systems
- Alloy Plus!
- NorthStar Dimension 300
- Our Business Machines' OA-Link

investigate using minicomputers

Zero-slot LANs
- Applied Knowledge Groups' The Knowledge Network
- IDEAssociates' IDEAshare
- Server Technology's EasyLAN
- The Software Link's LANLink
- Invisible Software's Invisible Network

Peer-to-peer resource sharing important? — yes →

Media-sharing LANs
- Digital Equipment Corp.'s DECnet with VAX-VMS Services for MS-DOS
- IBM Corp.'s Token-Ring Network
- Waterloo Microsystems' Waterloo Port
- Proteon's ProNET-4
- Recore Computer Products' LANpac 802.5 Token

Media-sharing LANs
- Gateway Communications' G/NET
- Novell's NetWare S-Net
- Proteon's ProNET-10
- Standard Microsystems Corp.'s ARCnet
- Texas Microsystems' Business-Pro LAN
- Tallgrass Technologies Corp.'s LanCourier
- Orchid Technology's PCnet
- 3Com Corp.'s Token-Ring
- 3Com Corp.'s Ethernet

Need high reliability and/or long-distance capability? — yes →

Fiber-optic LANs
- Codenoll Technology's Codenet
- Fox Research's 10-NET (fiber version)
- Proteon's ProNET-10 p10fo
- Pure Data's ARCnet (fiber version)

Use installed telephone wiring?

Media-sharing LANs
- AT&T Information Systems' 382/600 and StarLAN
- Fox Research's 10-NET
- Univation's LifeNet operating system plus LAN hardware
- Northern Telecom's Meridian LANStar PC

Benchmark Tests: ProNET-4 and LANpac 802.5 System

The results for the two Token-Ring alternatives were understandably similar. However, the 16-bit-wide interface of the ProNET-4 p1344 interface card used in the AT server improved performance under heavy load conditions (in this case, more than four workstations). Racore's LANpac and Proteon's ProNET-4 systems were faster than the Banyan and 3Com systems primarily because they were tested running under Novell's Advanced NetWare operating system, which handles data more efficiently than the software used in these other systems.

The PC Labs LAN benchmark tests are written in C and are independent of commercial software. We ran the tests on a test-bed of six 8-MHz IBM PC ATs. For our test-bed to better simulate the conditions on a medium-size network of 20 or more workstations, we designed these loading tests so that a single station represents five to ten times the load of a user performing an interactive task (for example, updating records) on a network.

By themselves, the elapsed times reported in these tests are not meaningful. They are valuable only when used to compare the performances of two or more systems running under near-identical conditions. Accordingly, we include the tests run on our Editor's Choice configuration of a 3Com 3Server3, 3 + Share software, and EtherLink interface cards to provide a point of comparison. We also show results from a network of Novell's Advanced NetWare/286, EtherLink cards, and an IBM PC AT as the server. Advanced NetWare is our Editor's Choice for networking software, and our tested configuration is a typical one. We also include the results of Banyan's system, which includes Banyan's DTS DeskTop Server, Meridian LANStar PC network interface cards, and VINES networking software. Banyan's LAN system has emerged as one of the top three players in the LAN marketplace.

The Network Speed Under Load and the Hard Disk Access Load benchmark tests measure the time needed to perform a standardized task on the network. While the actual work loads used for these two tests (described below) are different, we used the same procedures for both. To obtain the elapsed times shown here, we ran a benchmark program performing a sequential create, a sequential read, a sequential write, a random read, and a random delete of a large file. The record sizes used in these activities

systematically rotate between 18K, 4K, and 512 bytes. The numbers shown in the three-dimensional chart are the total time necessary for all of these operations. We ran the test on all our ATs to load the network while timing just one of them. We then reduced the number of workstations one at a time to show the effect of loading on the network.

The Network Speed Under Load test puts a heavy load on the network interface (cards, media, and so forth) while placing a minimal load on the hard disk by having each station continuously read and write its own 1-byte data file, changing the data each time. For systems with disk caching, the load on the hard disk is even smaller, since cached systems typically perform a disk write but do not require a physical disk read.

The Hard Disk Access Load test heavily loads the hard disk and disk-caching system. To do this, each station randomly accesses its own 100K data file using 1K records. Data written to the file is changed each time. The random reads typically access data outside the cache, which forces a disk read, as does any write.

The Database Load test exercises the system's record-locking support and the way it handles a number of random simultaneous accesses to a common file. This test times how fast each loading station accesses a common database consisting of an index and a data file. Half the accesses are simple searches of the index file and an accompanying access to a record in the data file. One quarter of the accesses perform the same operation but also lock the data record and update its contents. The remaining accesses update the index file and a data record. The index file is locked during every update and the DOS 3.1 RLOCK statement prevents simultaneous index file updates.

Network Speed Under Load
Performance Times
(Times given in seconds)

Server	Interface card	Software	Zero stations	One station	Two stations	Three stations	Four stations	Five stations	Six stations
Banyan DTS DeskTop Server	Meridian LANStar PC	VINES	667	762	935	1,085	1,238	1,463	1,718
3Com 3Server3	EtherLink	3 + Share	306	432	529	651	761	868	1,122
8-MHz IBM PC AT	LANpac 802.5	Advanced NetWare/286	409	425	435	470	523	573	612
8-MHz IBM PC AT	ProNET-4 p1340 PC and p1344 AT	Advanced NetWare/286	411	422	439	455	485	510	545
8-MHz IBM PC AT	LANpac 802.5	Advanced NetWare/286	264	280	301	310	322	345	349
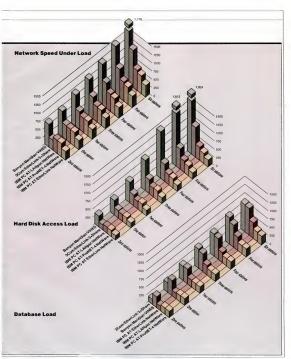
Hard Disk Access Load
Performance Times
(Times given in seconds)

Server	Interface card	Software	Zero stations	One station	Two stations	Three stations	Four stations	Five stations	Six stations
Banyan DTS DeskTop Server	Meridian LANStar PC	VINES	332	431	614	907	1,414	1,612	1,924
3Com 3Server3	EtherLink	3 + Share	155	227	330	419	522	620	902
8-MHz IBM PC AT	LANpac 802.5	Advanced NetWare/286	191	204	230	262	305	349	402
8-MHz IBM PC AT	ProNET-4 p1340 PC and p1344 AT	Advanced NetWare/286	192	208	260	278	280	288	349
8-MHz IBM PC AT	LANpac 802.5	Advanced NetWare/286	138	150	162	174	182	187	210

Database Load
Performance Times
(Times given in seconds)

Server	Interface card	Software	Zero stations	One station	Two stations	Three stations	Four stations	Five stations	Six stations
3Com 3Server3	EtherLink	3 + Share	155	298	423	585	669	799	824
Banyan DTS DeskTop Server	Meridian LANStar PC	VINES	332	468	446	533	630	667	806
8-MHz IBM PC AT	LANpac 802.5	Advanced NetWare/286	136	169	212	280	305	406	472
8-MHz IBM PC AT	ProNET-4 p1340 PC and p1344 AT	Advanced NetWare/286	191	199	206	211	223	232	269
8-MHz IBM PC AT	LANpac 802.5	Advanced NetWare/286	192	207	207	212	221	248	260

Network Speed Under Load

1,718.

Banyan/Meridian/VINES
3Com/EtherLink-3-Share
IBM PC AT/LAN/pc/NetWare
IBM PC AT/ProNET-4/NetWare
IBM PC AT/EtherLink/NetWare

Six stations
Five stations
Four stations
Three stations
Two stations
One station
Zero station

Hard Disk Access Load

1,812.   1,924.

Banyan/Meridian/VINES
3Com/EtherLink-3-Share
IBM PC AT/LAN/pc/NetWare
IBM PC AT/ProNET-4/NetWare
IBM PC AT/EtherLink/NetWare

Database Load

3Com/EtherLink-3-Share
Banyan/Meridian/VINES
IBM PC AT/EtherLink/NetWare
IBM PC AT/LAN/pc/NetWare
IBM PC AT/ProNET-4/NetWare

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racks and using the same cable connectors.

Several small external differences, however, provide a clue to the intelligence of the Proteon device. The Proteon wire center has a switch and a light under each connector. The light indicates that the station attached to that connector is active. The switch electrically disconnects the cable from the hub, so you don't have to physically unplug it.

STATION MASTERS Each Proteon wire center also has lights labeled "power" and "battery." Obviously, the hub requires AC power and has an internal battery backup. The relays in the Proteon hub set to the right positions automatically when the power comes on, eliminating the need to use and (more importantly) to find the small alignment tool used by IBM. The battery backup powers the unit through 4 hours of operation. While you don't need an alignment tool, you do need to supply

power to the Proteon wire hub. But since wiring closets have power available by definition, we think Proteon's design solution is a good one.

Proteon's second version of this hub, the p2710 Intelligent Wire Center, contains a microprocessor and a special communications link. This microprocessor links to any PC via the PC's RS-232C serial port. Proteon software running on the PC works with the Intelligent Wire Center to monitor signal quality, to respond to network events such as wire faults, and to compile a database on network operation.

You need only one of these Intelligent Wire Centers in the network, and it will interact with any other Proteon Multistation Wire Center to control the network.

Frankly, only a masochistic LAN manager would stick with the IBM wire center after seeing the Proteon system in operation, particularly for systems with multiple wire centers and many nodes.

SOFTWARE Proteon's *TokenVIEW-4* software offers a series of screens that give the network administrator a great deal of capability and information. Each screen contains a mini network event log that keeps the manager up to date on ring errors and on the latest stations joining and leaving the ring. You can use it to select a complete log of network events and lists of wire centers and nodes. The list of nodes shows stations according to both the serial numbers of their network adapters and the names (like "Fred's AT") you assign to each adapter card.

The network event log clearly shows which station's adapter cards are creating token errors. You can also use the *Token-VIEW-4* software to disconnect a station from the ring if Proteon wire centers are located throughout the ring. In effect, this means a network manager can troubleshoot a problem and restore network operation in seconds without entering a wire

closet or touching a single cable.

Another feature of the *TokenVIEW-4* software is that by using certain options, you can specify that only registered adapter cards are allowed on the ring. The software will automatically remove any unauthorized station entering the ring. If you have valuable information running over your LAN and don't have total control over access to every foot of cable, this security feature is valuable.

IN USE We assembled a Proteon ProNET-4 network with one p2710 Intelligent Wire Center and seven network nodes running under Novell's *Advanced NetWare*. The server contained a Proteon interface card designed for the 16-bit bus. Proteon sells an OEM version of Novell's *Advanced NetWare* with its cards preselected in *NetWare's* configuration menu.

We used standard IBM cable to connect the cards to the wire center. We also installed two IBM Token-Ring cards running under NetWare on two other network nodes and connected them to the Proteon wire center. We ran the *TokenVIEW-4* software from a separate IBM PC AT (although it can run on a network node).

The IBM and Proteon products played together without a hitch. It was interesting to watch the *TokenVIEW-4* display show the ring break and reform as stations entered and left. We had no malfunctions to troubleshoot, but it was easy to use *TokenVIEW-4* to delete nodes from the network. *TokenVIEW-4* uses a tiled window interface that adapts equally well to mouse or keyboard inputs.

BOTTOM LINE Proteon's ProNET-4 network interface cards are quality products in what looks like an opening commodity market. Our experience has shown that they will operate in a network that also has stations running on IBM's Token-Ring

cards and that they have an excellent interface with Novell's *Advanced NetWare*.

Racore's LANpac 802.5 System
(Media: Shielded twisted-pair cable)

Racore Computer Products' LANpac 802.5 System consists of a small wire center equipped with 9-pin connectors and the LANpac 802.5 network interface card, which interfaces with the 8-bit bus of a PC, XT, or AT. We tested the system using an AT as a server, running under Novell's Advanced NetWare. Like the Proteon and IBM systems, the Racore system uses a physical star topology but connects the network stations in an electrical ring.

We think every LAN manager should consider the Proteon Multistation Wire Center and Intelligent Wire Center instead of the IBM wire center. These units offer significant features (though at higher prices) that will be especially valuable to anyone with a large Token-Ring network.

RACORE COMPUTER PRODUCTS INC.
LANpac 802.5 System
Racore Computer Products' approach to the Token-Ring market combines compatibility with small size and low price.

The product itself is an IEEE-802.5-compatible network interface card and wire center. The cards sell for $495. The Racore Multiple Access Unit isn't much to look at, but it also isn't difficult to install or expensive to buy. Priced at $395, the unit, which is about half the size of competing hubs, fits easily under a desk, behind a cabinet, or anywhere power is available.

The Racore LANpac 802.5 System network interface card is based on the Texas Instruments TMS380 chip set. The company markets only an interface card with an 8-bit data bus and doesn't provide a card specifically designed for server use. The

Racore card uses the same 9-pin miniature connector used by IBM. We used the Racore cards on both the IBM and Proteon wire centers with no difficulty.

Because Racore's card is not one of the standard selections on Novell's *Advanced NetWare* operating system or shell generation menus, Racore provides files for you to use to generate versions of *NetWare* with the appropriate drivers. Adding the necessary Racore drivers to the Novell GENSH (generate shell) and GENOS (generate operating system) floppy disks is easy, however. You simply copy some files into a subdirectory on the appropriate Novell disks. Racore also provides a disk containing NETBIOS for use with programs such as IBM's *PC Local Area Network Program* or Torus's *Tapestry*.

The Racore 802.5 Multiple Access Unit contains no bells or whistles, lights or switches, but the relays in the unit align themselves without a separate alignment tool when power comes on. You do, however, need to place the Racore MAU near a wall socket, and a small wall-plug transformer supplies power to the unit. There is no backup battery. Logically, if you want backup power for the MAU, you'll also want backup power for the server and other network nodes. Because of the MAU's small size, you can keep it near a network node and share the backup power source.

The selling points of the Racore MAU are its size and price, both of which result from Racore's use of 9-pin subminiature connectors instead of the larger and more-expensive 802.5 dual-purpose connectors.

The Racore Model 8306 Multiple Access Unit is 4½ inches wide, 9¾ inches long, and 1¼ inches high, or about half the size of competing units. Ten 9-pin connectors line its edges. Eight of the connectors are for network adapter cards; the other two are for extensions leading to other MAUs, which can also be MAUs from other manufacturers. However, it is important to note that if other MAUs are not attached, you must install loopback plugs—which are dummy 9-pin connectors with loopback wiring inside—in the ring extension jacks.

There are pros and cons to using 9-pin connectors on the MAU. On the one hand, they are small, inexpensive, and available, unlike the multipurpose connectors used

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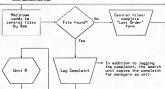
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by IBM and Proteon. On the other hand, you can attach and disconnect IBM and Proteon's multipurpose connectors in just a few seconds, while you must screw and unscrew Racore's 9-pin connectors, a process that requires a small screwdriver and some dexterity and takes about a minute. This can be frustrating when you're troubleshooting a LAN by disconnecting each station from the MAU. But if you never experience a malfunctioning interface card, the smaller and cheaper Racore connectors are a benefit.

MIX AND MATCH When we used the Racore MAU with interface cards from IBM, Proteon, and Racore, all worked together well. We connected the Racore MAU to the Proteon MAU and attached stations to both hubs, and they all communicated with the same network. The Proteon Intelligent Wire Center reported when stations entered the ring through the Racore MAU, but it couldn't control the access of individual stations on the Racore MAU.

If you want to expand an existing system or start a new one at a reasonable price and with little hassle over special connectors, the Racore LANpac Token-Ring system is an alternative you should definitely consider.

Frank J. Derfler, Jr., is a contributing editor of PC Magazine.

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PRODUCTIVITY

■ PC LAB NOTES: OS/2 INSTALLATION ■ CHARLES PETZOLD

CLEANING UP AFTER IBM, PART 2

IBM's OS/2 installation program is handy but lacks finesse when it comes to organizing files. Here are some alterations you can make to increase your hard disk's breathing room.

In the previous column I reviewed the IBM OS/2 installation process and the file structure it leaves on your hard disk. We began to better organize your hard disk to accommodate OS/2 by moving files and creating subdirectories. In this installment, I'll show you how to make sure the cleanup is complete. As a bonus, I'll discuss the OS/2 files that you can remove from your hard disk and never know they're missing.

USER-INSTALLED DEVICE DRIVERS

User-installable device drivers are files with an .SYS extension that you can install by using DEVICE statements in the CONFIG.SYS file. After installing OS/2, all user-installable device driver files are located in the \OS2 subdirectory. Let's move them to a directory named \OS2\SYS, instead.

```
MD \OS2\SYS
COPY \OS2\*.SYS \OS2\SYS
DEL \OS2\*.SYS
```

When you executed that DEL command, were you expecting to get another error message telling you that the .SYS files were being used by another process? The reason you didn't get it is that OS/2 loads .SYS files into memory at boot-up. Code segments in .SYS files cannot be discarded from memory, so OS/2 has no reason to prevent the files from being deleted.

User-installable device drivers are usually "dual-mode" drivers. That is, they apply to both OS/2 Mode and DOS Compatibility Mode. For this reason, they are loaded into the lower 640K of memory.

To reflect the new directory in which the .SYS files are stored, you'll have to change all of the statements in CONFIG.SYS that read

```
DEVICE = C:\OS2\driver.SYS
```

to instead be in the form of

```
DEVICE = C:\OS2\SYS\driver.SYS
```

where *driver* is the name of one of the .SYS files. These driver files are documented in IBM's *OS/2 User's Reference*, so I'll discuss them only briefly here.

The ANSI.SYS driver has been with us since DOS 2.0. This is one of two OS/2 device drivers that work in DOS Mode only. (ANSI screen and keyboard control is built into OS/2 Mode and handled by the ANSI-CALL.DLL dynamic link library.) The other device driver that affects only DOS Mode is EGA.SYS. If you have an EGA, EGA.SYS should always be installed.

All other device drivers are used by both OS/2 Mode and DOS Compatibility Mode. They have the same file format as dynamic link libraries.

The EXTDSKDD.SYS driver replaces the DOS 3.3 DRIVER.SYS and allows you to access an external diskette drive using two different drive letters. The COM01.SYS and COM02.SYS device drivers allow you to use the serial ports in OS/2 Mode. COM01.SYS is for the AT; COM02.SYS is for the PS/2.

POINTDD.SYS is a "pointer device driver" that supports a pointing device such as a mouse. If you have a mouse, you need a DEVICE statement for POINTDD.SYS and a second DEVICE statement referencing one of the nine mouse device drivers included in OS/2. (IBM's installation program copies all nine mouse drivers to your hard disk, just in case you happen to have nine mice installed on your machine.)

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Finally, there's VDISK.SYS, a familiar sight since DOS 2.1. I always like to have a small RAMdisk around as a "scratch pad" area for creating temporary files. You can create a small 64K RAMdisk by adding the line

```
DEVICE = C:\OS2\SYS\VDISK.SYS
```

to the CONFIG.SYS file. You can create a larger RAMdisk by adding a parameter that indicates the size in kilobytes. Under OS/2, the RAMdisk is always installed in extended memory. If you have one hard disk and no external diskette drives, the RAMdisk will be installed as drive D:.

A warning: After you install a RAMdisk, you might be tempted to specify that OS/2 use the RAMdisk for swapping by changing the SWAPPATH statement in CONFIG.SYS like this:

```
SWAPPATH = D:\
```

But that makes no sense at all! If you have a RAMdisk large enough to store the swap file, then OS/2 would not need to do swapping at all if the RAMdisk were not installed. (Think about it.) However, you can speed up printing just a little if you specify that SPOOL.EXE use the RAMdisk for storing its temporary files.

SYSTEM DEVICE DRIVERS In addition to the .SYS files now in the \OS2 \SYS subdirectory, there are some .SYS files in the root directory. OS/2 loads these

■ **The install program copies files for both the AT and the PS/2 to your root directory.**

device drivers automatically while booting, and they must be in the root directory of the boot disk. However, you have more .SYS files than you need. The IBM installation program copies files for both the AT and the PS/2 to your root directory regardless of which machine you have.

The COUNTRY.SYS file is used for both the AT and the PS/2. It contains coun-

try-dependent information. These .SYS files are used only by the AT:

```
CLOCK01.SYS
DISK01.SYS
KBD01.SYS
PRINT01.SYS
SCREEN01.SYS
```

The following .SYS files are used only by the PS/2:

```
ABIOS.SYS
CLOCK02.SYS
KBD02.SYS
PRINT02.SYS
SCREEN02.SYS
```

Under DOS, device drivers for the clock, disk drives, etc., were part of IBMBIO .COM, a file that grew larger with each successive DOS version. The OS/2 version of IBMBIO.COM is only 4K long.

The ABIOS.SYS driver used in the PS/2 takes advantage of the PS/2 "Advanced BIOS" routines that run in protected mode. But take a look at the contents of ABIOS.SYS by entering

```
TYPE ABIOS.SYS
```

You'll find that it's not really a .SYS file at all but a simple ASCII file containing a list of four other files:

```
F80080.BIO
F80100.BIO
FC0400.BIO
FC0500.BIO
```

These files are also in your root directory.

If you have a PS/2, the .SYS files with a 01 in the name are not needed in the root directory. If you have an AT, the .SYS files with a 02 in the name and the four .BIO files are not needed in the root directory.

Let's move the unneeded files to the \OS2\SYS directory just to get them out of the way. For example, if you have a PS/2, you'll execute commands like

```
COPY CLOCK01.SYS \OS2\SYS
DEL CLOCK01.SYS
```

and so forth.

THE CODE PAGE FILES OS/2 includes four "code page" files with the extension .DCP. The installation program copies these files to the root directory. The .DCP files are referenced by DEVINFO statements in the CONFIG.SYS file.

A "code page" is the same thing most of us call a character set. These files allow the use of foreign language keyboards and international character sets on the EGA, VGA, IBM 4201 Proprinter, and IBM 5202 Quietwriter printer. So, let's move these .DCP files to a directory named \OS2\DCP:

```
MD \OS2\DCP
COPY \*.DCP \OS2\DCP
DEL \*.DCP
```

Now change all references to these .DCP files in CONFIG.SYS to indicate the new directory. For example, you would change the command

```
DEVINFO = SCR,VGA,C:\VIOTBL.DCP
```

to instead say

```
DEVINFO = SCR,VGA,C:\OS2\DCP\VIOTBL.DCP
```

If you're using a U.S. keyboard, you don't need any DEVINFO files at all in CONFIG.SYS. The OS/2 installation always adds the DEVINFO line shown above, but you can delete it from the CONFIG.SYS file if you want.

DOSCALLS IMPORT LIBRARY The \OS2 subdirectory contains a file named DOSCALLS.LIB. This is an "import library." If you write programs for OS/2, you'll run the OS/2 LINK program to create an .EXE file of your program. When you run LINK, you specify DOSCALLS .LIB as a library for LINK to use. DOSCALLS.LIB contains information that allows LINK to construct a table in the .EXE file that allows OS/2 to perform dynamic linking when the program is run.

Let's move this file to a directory called \OS2\LIB thus:

```
MD \OS2\LIB
COPY \OS2\DOSCALLS.LIB \OS2\LIB
DEL \OS2\DOSCALLS.LIB
```

If you later write OS/2 programs under OS/2, you'll add a statement like this to the OS2INIT.CMD file:

```
SET LIB = C:\OS2\LIB
```

This allows LINK.EXE to find the DOSCALLS.LIB file.

■ PC LAB NOTES

LIBRARY MADNESS The word "library" and the extension .LIB are used for several different types of files in DOS and OS/2. This naming convention obviously creates some confusion—let's try to sort them out.

DOS programmers are familiar with "object code libraries," which have the extension .LIB. These files contain code for frequently used subroutines. When a program is being linked, code from the library files is brought into the .EXE file. Object code libraries are usually supplied with compilers; no object code libraries are included with OS/2.

The DOSCALLS.LIB "import library" I just discussed is structured very much like an object code library, and it is also used by LINK. However, instead of containing code, the import library contains information necessary for LINK to construct an .EXE file so the program can call routines located in any dynamic link libraries.

The word "library" is also used when speaking about "dynamic link libraries." These files have the extension .DLL and contain functions that an OS/2 program can call when it is running. (More details about dynamic link libraries can be found in my Environments column in *PC Magazine*, October 27, 1987.)

You'll also find three other OS/2 files that have a .LIB extension: SHELL-11F.LIB in the root directory, INTRO .LIB in the \OS2\INTRO directory, and INSTAID.LIB in the \OS2\INSTALL directory. These files contain templates for the various screens and windows displayed in the Program Selector, the "Introduction to OS/2" program, and the installation program. To avoid confusion, these files should obviously have been given a different extension, but there's not much we can do about that.

THE EXECUTABLE PROGRAMS At this point, the \OS2 directory contains all the external commands with .COM or .EXE extensions, and the files HELP .BAT, HELP.CMD, and MORTGAGE .BAS. (Would an IBM operating system be complete without MORTGAGE .BAS?)

You may have heard that OS/2 does not support .COM files, only .EXE files. So

why does OS/2 include a bunch of .COM files that run in OS/2 Mode? Well, despite the .COM extension, these are really .EXE files. But some existing DOS programs execute these external commands from within the program. Thus, these DOS programs explicitly refer to a file with the .COM extension. If the OS/2 versions of these files did not continue to have a .COM extension under OS/2, such DOS programs would not work under OS/2's DOS Compatibility Mode.

Let's move these programs into a subdirectory named \OS2\PRG, like this:

```
MD \OS2\PRG
COPY \OS2\*.* \OS2\PRG
```

Virtually all of these files are sufficiently documented in the *OS/2 User's Reference*, and many of them are familiar external commands, so I won't discuss them here. However, notice that the IBM manual only documents the HELP command and not the HELPMSG.EXE program. HELP is actually a batch file: the HELP.CMD batch file runs in OS/2 Mode and the HELP.BAT file runs in DOS Compatibility Mode. Both these batch files call HELPMSG.EXE to display help information.

HELPMSG.EXE accesses an ASCII file named OSO001H.MSG for this help information. This file is stored in the root directory, but you can move it to \OS2\PRG thus:

```
COPY \OSO001H.MSG \OS2\PRG
```

After moving all the external commands into the \OS2\PRG subdirectory, you should change the PATH and DPATH statements in OS2INIT.CMD, which is the OS/2 Mode "auto exec" file. OS2IN-IT.CMD is stored in the root directory. Change the PATH and DPATH statements in OS2INIT.CMD to these:

```
PATH C:\OS2\PRG
DPATH C:\OS2\PRG
```

The DPATH statement specifies a data file search path, and it is needed only so that HELPMSG.EXE can find OSO001H .MSG.

The reference to \OS2 in the PATH statement in your AUTOEXEC.BAT file should also be changed to \OS2\PRG. Further, you should add to your AU-

TOEXEC.BAT file an APPEND statement (which is the DOS Compatibility Mode equivalent of DPATH):

```
APPEND C:\OS2\PRG
```

This allows HELPMSG.EXE to find OSO001H.MSG when you run HELP or HELPMSG under DOS Compatibility Mode.

You'll also have to change the directory for SPOOL.EXE in the CONFIG.SYS file:

```
RUN = C:\OS2\PRG\SPOOL.EXE [etc]
```

Now, after you reboot, you can delete everything in the \OS2 directory and also the OSO001H.MSG file in the root directory, thus:

```
DEL \OS2\*.*
DEL \OSO001H.MSG
```

THE COMMAND PROCESSORS The root directory contains two command processors that display the command line prompt and execute internal commands. COMMAND.COM is familiar from DOS and is the command processor that runs in the DOS Compatibility Mode. CMD.EXE is the OS/2 command processor. Both these files can be moved to the \OS2\PRG subdirectory:

```
COPY \COMMAND.COM \OS2\PRG
COPY \CMD.EXE \OS2\PRG
```

In CONFIG.SYS, change the PROT-SHELL ("protected-mode shell") statement to this:

```
PROTSHELL = DMPC.EXE SHELL11F.CNF
  SHELL11F.EXE C:\OS2\PRG\CMD.EXE /C
  OS2INIT.CMD
```

[The above must be typed as a single line.—Ed.] Similarly, change the SHELL statement to this:

```
SHELL = C:\OS2\PRG\COMMAND.COM
  C:\OS2\PRG /P /E:1024
```

[The above must also be typed as a single line.—Ed.] After you reboot you can delete the two command processors from the root directory:

```
DEL \COMMAND.COM
DEL \CMD.EXE
```

When OS/2 boots up, it normally leaves you in the Program Selector. If you would rather be left at an OS/2 command

■ PC LAB NOTES

line, you can create a file named START-UP.CMD in the root directory. This file can contain commands that must be run only once when you boot up (such as copying some files to a RAMdisk), followed by the line

```
OS2INIT.CMD
```

OS2INIT.CMD is also executed when you start a new OS/2 session from the Program Selector.

FILES IN THE ROOT DIRECTORY
By this time, your root directory should be looking a little less crowded. You can get rid of two additional files in the root directory like this:

```
DEL \INSTALL.LOG
DEL \SYSBAS.EXE
```

These files are merely by-products of the installation process.

The root directory contains the two hidden files IBMBIO.COM and IBMDOS .COM, but you won't see these with a DIR command. These files must remain where they are. The root directory also has all the .SYS files for the clock, disk, keyboard, etc., and (if you have a PS/2) the .BIO files. These files must remain in the root.

You have four ASCII files that are used for starting the system and executing commands in OS/2 Mode and DOS Compatibility Mode sessions: CONFIG.SYS, STARTUP.CMD, OS2INIT.CMD, and AUTOEXEC.BAT. All of these except

OS2INIT.CMD must remain in the root directory. OS2INIT.CMD does not have to be in the root directory, nor does it have to be named OS2INIT. If you want to change the name or location of this file, you just have to specify it in the PROT-SHELL statement of your CONFIG.SYS file.

The Program Selector comprises six files in the root directory, as shown in the accompanying table "Program Selector Files." You can move SHELL11F.EXE and SHELL11F.CNF to another directory if you change the PROTSHELL statement in CONFIG.SYS, but the statement will look even messier than it does already, so let's keep all these SHELL11F files in the root directory.

Besides SHELL11F.EXE, you also have three other .EXE files in the root directory: HARDERR.EXE, SWAPPER .EXE, and DMPC.EXE. The first two must be in the root directory because they are loaded when OS/2 boots. HARDERR .EXE handles pop-up screens for "abort, retry, fail" errors and SWAPPER.EXE handles swapping. DMPC.EXE is more problematic. It does not have to be in the root directory, but if it is moved out, the PROTSHELL statement in CONFIG.SYS must be changed as well as batch files in the INTRO and INSTALL directories. Leave it in the root directory.

You'll also find three files that are named with the .MSG (message) extension: OSO001.MSG, ISPD.MSG, and

ISPM.MSG. Most text that is displayed by internal and external OS/2 commands is in OSO001.MSG. The message text is separated into a different file to allow easy conversion of the programs to foreign language markets. These files must be in the root directory.

CHANGING FORMATS.TBL
Finally, the root directory contains an ASCII file named FORMATS.TBL. You can display the contents of this file by using the TYPE command.

When you format a diskette with the /S option under DOS, FORMAT copies IBMBIO.COM, IBMDOS.COM, and COMMAND.COM to the target disk. However, under OS/2, more files are needed to create a bootable disk. FOR-MATS.TBL contains a list of these files. FORMATS.TBL must be in the root directory for FORMAT to access it.

If you've been following the steps in this article, however, some of the files listed in FORMATS.TBL have been moved to other directories. Thus, if you want to create bootable diskettes, you must edit this file and change the affected lines. For example, the .DLL files are now in \OS2 \DLL. So, any line in FORMATS.TBL such as

```
filename.DLL
```

should be changed to

```
C:\OS2\DLL\filename.DLL
```

After you change FORMATS.TBL, try formatting a diskette with the /S parameter to see if you changed all of these filenames correctly. FORMAT will report which files it could not find.

WHAT YOU CAN DELETE
Although OS/2 comes with up 3 megabytes of hard disk space, you can reclaim some of that space by deleting files you don't need. For example, you can reclaim 128K by going into the \OS2\SYS directory and deleting all the mouse drivers you don't need. (If you ever got a new mouse, you can always copy the appropriate mouse driver from the original OS/2 "Diskette 3.")

IBM's OS/2 comes with a program called "Introduction to OS/2." By all means, check it out. If you're still awake when the program ends, you can type

Program Selector Files

SHELL11F.EXE	Program Selector program.
SHELL11F.LIB	Templates for screen and windows.
SHELL11F.PRO	Application profile file.
SHELL11F.CNF	Configuration file.
SHELL11F.All	Contains list of programs that can be run from the Program Selector.
SHELL11F.AIF	Contains information needed for running the programs listed in SHELL11F.All.

The Program Selector comprises six files in the root directory.

■ UTILITIES ■ JEFF PROISE

SPLITTING UP THE KEYBOARD COMBOS

Only basketball players can hit Shift-F6 on the new IBM keyboards, and the handicapped have always deserved a way to separate keystroke combinations. STAYDOWN is the answer.

N obody at IBM can type. That seems a fair inference, at least, from the company's history of changing keyboard layouts every couple of years. Not content with the infamous left-shift and backslash placement on the original PC and XT, the PC AT shifted the Esc, tilde, and backslash keys in 1984. Two years later IBM produced its 101-key "Enhanced" keyboard, which, among other things, relocates all the function keys we'd spent thousands of hours training our fingers to find without thinking.

Maybe our muscle memories for the old function-key arrangement will pass away, but so too will the convenience of entering key combinations like Ctrl-F8 and Alt-F1 with one hand. Best-selling word processors, spreadsheets, databases, and utilities of every ilk popularized and perfected the use of the 40 function-key combinations. They polished their user interface to make every feature of an application available through single keystroke combinations that never required the right hand to move from home position. But not with IBM's "Enhanced," model-of-the-future keyboard. It's as if a company that can't sell its own software actually wants to make everyone else's software equally unsuccessful.

There's nothing software can do to relocate the function keys, but a bit of keyboard trickery can make the situation slightly more livable. STAYDOWN, the keyboard utility introduced here, turns awkward keystroke combinations into keystroke sequences. It temporarily locks down (ignores the break code of) any Ctrl, Alt, or Shift key that is pressed until it re-

ceives the break code from a second key. Thus, the Alt-S combination becomes Alt followed by S, and *SideKick* can be popped up by pressing and releasing Ctrl, then touching Alt.

STAYDOWN works in the background and has no effect on normal keyboard operation. It offers you the option of breaking a double-keystroke combination into its component parts, but it does not require you to do so. And it's perfectly compatible with all members of the IBM family, including the 101-key keyboard with its dual Ctrl and Alt keys and 83- and 84-key progenitors.

STAYDOWN will also provide welcome relief for handicapped members of the user community who are physically limited to pressing a single key at a time. Try printing a *WordPerfect* document by simultaneously pressing the Left Shift and F7 keys with a mouthstick and you'll understand why these men and women repre-

> ■ STAYDOWN turns awkward keystroke combinations into keystroke sequences. Thus, Alt-S becomes Alt followed by S.

sent some of the most dedicated and persistent users in the industry.

As usual, the easiest way to obtain STAYDOWN.COM is to download it from the PC Magazine Interactive Reader Service, as described in the sidebar "STAYDOWN by Modem." The source code, STAYDOWN.ASM, and STAYDOWN.BAS, which you can use to create STAYDOWN.COM, are listed here and are also available on the PC-IRS.

USING STAYDOWN STAYDOWN is a short memory-resident utility that includes the capabilities of temporarily disabling itself on command and even of completely removing itself from memory. The command syntax is

    STAYDOWN [/D] [/U]

The optional /D parameter allows you to suspend operation of a copy already in memory, and /U uninstalls the utility altogether. Once disabled, STAYDOWN can be reactivated by being run again without any command line switches, just as if it were being loaded for the first time.

You lock the Ctrl, Alt, Left Shift, or Right Shift key down temporarily simply by pressing and releasing it. (I'll refer to these four hereafter as "shift" keys, using the lowercase "s" to distinguish the term from the name given the Left Shift and Right Shift keys on the keyboard.) The next key—and only the next key—you strike will be affected as if the shift key were still being held down. When the second key is released, the temporary shift state induced by STAYDOWN will be re-

■ UTILITIES

moved automatically and your keyboard will act as it normally does. If you have *SideKick* loaded and ready for action, pop it up by pressing and releasing the Ctrl key, then pressing Alt. Or enter *WordPerfect's* Screen menu by pressing the Ctrl key followed by F3.

You can cancel STAYDOWN's induced shift state by pressing and releasing the same key again. If you press Ctrl, for instance, then realize you meant to press Alt instead, just tap Ctrl once again to toggle it off. Then you can start from scratch to enter the Alt combination you had originally intended.

You can still enter key combinations by pressing the designated keys simultaneously, even if STAYDOWN is loaded and active. When STAYDOWN senses that a shift key is pressed in conjunction with another key in the conventional manner, it doesn't lock the shift key; rather, it allows the BIOS to process each make and break so that normal keyboard activity is unhindered.

Note, however, that triple combinations like Ctrl-Alt-Del can't be executed a stroke at a time. Since the Ctrl state would be toggled off after Alt is released but be-

■ **You can still enter key combinations by pressing the designated keys simultaneously, even if STAYDOWN is loaded and active.**

fore Del is pressed, STAYDOWN is suitable only for combinations of two keys.

While STAYDOWN is compatible with most major application programs, you'll undoubtedly find a few that won't

let it work. This is true of any termination-and-stay-resident program. Even those applications that are incompatible, however, should return control of the keyboard to STAYDOWN when they terminate.

When run initially, STAYDOWN will display its version number and a copyright notice. Reinvoke it with a /D parameter, and you'll receive the reply "STAY-DOWN: Disabled." Type STAYDOWN once more at the command line and it will answer "STAYDOWN: Activated." If you attempt to uninstall it with the /U parameter and another TSR has grabbed the same interrupt vector STAYDOWN borrowed, it will ignore the request and inform you, "Cannot Uninstall." If this happens, the only way (short of rebooting) to remove it from memory is with the aid of a commercial TSR manager, or with something along the lines of the IN-STALL/REMOVE utilities that appeared in *PC Magazine's* "Popping Out Your Pop-ups," PC Lab Notes, August 1987.

If STAYDOWN ever responds to your

```
; STAYDOWN holds the CTRL, ALT, and SHIFT keys temporarily toggled on,
; allowing keystroke combinations to be entered with sequential rather
; than simultaneous presses.  Syntax is:
;
;        STAYDOWN [/D | /U]
;
; where /D disables the program until it is run again from the
; command line, and /U uninstalls it.

                ASSUME  CS:CODE, DS:NOTHING, ES:NOTHING, SS:NOTHING
                STI                             ;Exit to DOS if program
                CMP     CS:DISABFLAG,0          ;      isn't currently enabled
                JZ      PASS_TO_BIOS
                ...
BDATA           EQU     488                     ;Keyboard data port
KBCTRL          EQU     618                     ;Keyboard control port
ALT             EQU     B38h                    ;Scan code for ALT key
CTRL            EQU     01Dh                    ;Scan code for CTRL key
LSHIFT          EQU     02Ah                    ;Scan code for left SHIFT key
RSHIFT          EQU     036h                    ;Scan code for right SHIFT key
CS              EQU     01h
LP              EQU     0Eh
BREAK           EQU     080h

;9106 Data Area

                ASSUME  DS:NOTHING
BIOS_DATA       SEGMENT AT 488h
                ORG     17h
SHIFT_STATE_1   DB      ?                       ;Primary shift state byte
SHIFT_STATE_2   DB      ?                       ;Left CTRL/ALT (bits 1, 3)
                ORG     96h
SHIFT_STATE_3   DB      ?                       ;Right CTRL/ALT (bits 2, 3)
BIOS_DATA       ENDS

;Code segment (code and data)

CODE            SEGMENT PARA PUBLIC 'CODE'
                ASSUME  CS:CODE, DS:CODE, ES:CODE, SS:CODE
BEGIN:          ORG     100h
                JMP     INSTALL

PROGRAM         DB      'STAYDOWN 1.0 (c) 1988 Ziff Communications Co.',CR,LF
AUTHOR          DB      'PC Magazine ',254,' Jeff Prosise',CR,LF,'$',1Ah

CHECKFLAG       DB      0                       ;Enable/disable flag
RESTORE_FLAG    DB      0                       ;Break code ignored flag
LAST_SCAN_CODE  DB      0                       ;Last scan code
DS_FLAG         DB      0                       ;AND = last scan was ESD
RE_VECTOR       DB      0                       ;Vector altered to trap keys

BIOS_INT        LABEL   DWORD
OLD_VECTOR      DD      1 DUP (?)               ;old interrupt 9/15h vector

;INT9H handles interrupt 9 on machines that lack interrupt 15h keyboard
;processing facilities.

INT9H           PROC    FAR
```

```
                ASSUME  CS:CODE, DS:NOTHING, ES:NOTHING, SS:NOTHING
                STI                             ;Exit to BIOS if program
                CMP     CS:DISABFLAG,0          ;   isn't currently enabled
                JZ      PASS_TO_BIOS
                PUSH    AX                      ;Interrupt 9h
                IN      AL,BDATA                ;Read scan code from keyboard
                CALL    MAIN                    ;Perform internal processing
                MOV     RESET_KEYBOARD          ;Ignore scan code if CF = 0
                POP     AX
                IRET
PASS_TO_BIOS:                                   ;Jump to BIOS int handler
                POP     AX
                JMP     CS:BIOS_INT

RESET_KEYBOARD: IN      AL,KBCTRL               ;Reset the keyboard
                MOV     AH,AL
                OR      AL,80h
                OUT     KBCTRL,AL
                MOV     AL,AH
                OUT     KBCTRL,AL

                MOV     AL,20h                  ;Signal EOI to interrupt
                OUT     20h,AL                  ;   controller
                POP     AX
                IRET                            ;Exit without processing
INT9H           ENDP

;INT15H handles interrupt 15h on machines with an extended 9106.

INT15H          PROC    FAR
                ASSUME  CS:CODE, DS:NOTHING, ES:NOTHING, SS:NOTHING
                CMP     AX,4F0                  ;Exit to BIOS handler if
                JNE     EXIT_TO_BIOS            ;   function code <> 4Fh
                STI                             ;Interrupt on
                CMP     CS:DISABFLAG,0          ;Process scan code as normal
                JZ      PROCESS_SCAN_CODE       ;   if program is disabled
                ...
                MOV     AL,BH6h                 ;Set flag and terminate if
                JNC     HOT_KEY                 ;   scan code = BRK
                SHORT   PROCESS_SCAN_CODE

HOT_KEY:        CMP     CS:DS_FLAG,0            ;Branch if ES flag not set
                JZ      CHECK_CODE
                CMP     AL,BRK                  ;If this scan code is part of
                JNE     RESET_ES_FLAG           ;   a 4-code sequence, then
                MOV     AL,AH                   ;   reset ES flag and process
                OR      AL,B0h                  ;   the scan code
RESET_ES_FLAG:  CMP     AL,88h
```

(continues)

STAYDOWN.ASM: *The assembly language source code for STAYDOWN.COM.*

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■ UTILITIES

```
                JNE     CHECK_CODE
RESET_EQ_FLAG:  MOV     CX:EQ_FLAG,0            ;Reset flag
                JMP     SHORT PROCESS_SCAN_CODE ;Process the scan code

CHECK_CODE:     PUSH    AX
                CALL    MAIN                   ;Perform internal processing
                POP     CX:EQ_FLAG,0
                RET     2                      ;Return with flags intact

PROCESS_SCAN_CODE:
                STC
                IN      CX:BIOS_IRZ            ;Return with flags intact
                JZ                             ;Return with flags intact
                                               ;Pass to BIOS for processing
INT15A          ENDP

;MAIN is called by the two interrupt handling routines to process a keystroke.
;Entry: AL = scan code

MAIN            PROC    NEAR
                ASSUME  CS:CODE, DS:NOTHING, ES:NOTHING, SS:NOTHING
                TEST    AL,80H                 ;Branch on break code
                JNZ     BREAK_CODE

;Process a make code by simply saving the scan code.

                OR      AL,CX:EQ_FLAG          ;Save EQ indicator
                MOV     CX:LAST_SCAN_CODE,AL   ;Save scan code
                RTC                            ;Exit with CF = 1
                RET

;A break code was received.

BREAK_CODE:     CMP     CX:RESTORE_FLAG,0      ;Branch if shift bits are
                AND     AL,7FH                 ; out of sync
                MOV     AL,77H                 ;Strip break bit
                CMP     AL,CX:EQ_FLAG          ;Add EQ indicator
                JE      AL,CX:LAST_SCAN_CODE   ;Branch if the key released
                JNE     CHECK_FOR_SHIFT        ; was the last one passed
                MOV     LAST_SCAN_CODE,0       ;Process break code as normal
                STC
                RET

;Ignore the break if the key just released was a shift key.

CHECK_FOR_SHIFT:
                CMP     AL,ALT                 ;Check codes for ALT, CTRL,
                JE      IGNORE_BREAK           ; and SHIFT keys
                CMP     AL,CTRL
                JE      IGNORE_BREAK
                CMP     AL,CTRL+REN
                JE      IGNORE_BREAK
                CMP     AL,SHIFT
                JE      IGNORE_BREAK
                CMP     AL,RSHIFT
                JNE     PROCESS_BREAK

IGNORE_BREAK:   MOV     CX:RESTORE_FLAG,AL     ;Ignore the break code
                MOV     CX:LAST_SCAN_CODE,0
                CLC                            ;Return with CF = 0
                RET

;Reset the #100 shift bits corresponding to the last key release ignored.

RESTORE_SHIFT_BITS:
                MOV     AL,CX:RESTORE_FLAG,0   ;Recover ignored scan code
                MOV     CX:RESTORE_FLAG,0      ;Reset flag
                PUSH    DS                     ;Point ES to BIOS data area
                MOV     AX,40H
                MOV     DS,AX
                CMP     AL,468H
                JNE     NOT_SHIFT              ;Reset a single bit if
                AND     BYTE DS:[417H],0FEH    ; right SHIFT key was
                JMP     SHORT DEC_RESTORE      ; released

NOT_SHIFT:      CMP     AL,LSHIFT              ;Likewise for left SHIFT
                JNE     NOT_LSHIFT
                AND     BYTE DS:[417H],0FDH
                JMP     SHORT DEC_RESTORE

NOT_LSHIFT:     CMP     AL,RCTRL               ;Reset right CTRL key bit
                MOV     NOT_RCTRL
                AND     BYTE DS:[418H],0FBH
                JMP     SHORT DEC_RESTORE

NOT_RCTRL:      CMP     AL,CTRL                ;Reset two left CTRL bits
                MOV     NOT_LCTRL
                AND     BYTE DS:[417H],0FBH
                AND     BYTE DS:[418H],0F9H    ;if this is a 101-key
                JE      DEC_RESTORE            ; keyboard
                AND     BYTE DS:PRIMARY_SHIFT  ;

NOT_LCTRL:      CMP     AL,ALT+REN             ;Reset right ALT key bit
                JNE     NOT_RALT
                AND     BYTE DS:[417H],0F7H
                JMP     SHORT FIX_PRIMARY_SHIFT

NOT_RALT:       CMP     AL,CTRL                ;Reset two left ALT bits
                JNE     DEC_RESTORE
                AND     BYTE DS:[417H],0F7H
                TEST    BYTE DS:[418H],10H     ;Test for 101-key keyboard
                JZ      DEC_RESTORE            ;Branch if 1-t not

FIX_PRIMARY_SHIFT:
                AND     AX,BI:[SHIFT_STATE_3]  ;Set CTRL/ALT bits in primary
                SEL     AX,1                   ; shift state byte if either
                SEL     AX,1                   ; left or right CTRL/ALT is
```

```
                OR      AX,BI:[SHIFT_STATE_2]  ; pressed
                OR      AX,BI:[SHIFT_STATE_1],0r20
END_RESTORE:    POP     DS
                JMP     PROCESS_BREAK

MAIN                                           ;Process the break code

;-------------------------------------------------
;INSTALL installs the program into memory.
;-------------------------------------------------
HEADING2        DB      CR,LF,"STAYDOWN: $"
ERRMSG1         DB      "Usage: STAYDOWN [/D][/U]",CR,LF,"$"
ERRMSG2         DB      "Not installed",CR,LF,"$"
ERRMSG3         DB      "Cannot Uninstall",CR,LF,"$"
EXPANS0         DB      "Uninstall Error",CR,LF,"$"
CONFIRM_MSG1    DB      "Disabled",CR,LF,"$"
CONFIRM_MSG2    DB      "Uninstalled",CR,LF,"$"
CONFIRM_MSG3    DB      "Activated",CR,LF,"$"

INSTALL_FLAG    B       0

INITIALZE       PROC    NEAR
                ASSUME  CS:CODE,DS:CODE,SS:CODE,ES:CODE
;
;See if STAYDOWN is already installed.
;
                CLD                            ;Clear DP
                MOV     WORD PTR [68H],0       ;Initialize fingerprint
                MOV     AX,ES                  ;Initialize segment values
                ASSUME  DS:NOTHING
INIT1:          MOV     DS,AX
                MOV     SI,0FFSET BEGIN        ;advance to next segment
                MOV     CX,8
                MOV     DI,0FFSET BEGIN        ;Look at long back
                REPE    CMPSB                  ; to the current segment
                JNE     INIT1                  ;Check for ASCII fingerprint
                JNE     INSTALL_FLAG,1         ;Program is already installed

;Parse the command line for a /D or /U parameter.

PARSE:          MOV     AL,1
PARSE1:         MOV     BYTE PTR [SI],5CH      ;advance to command line
                MOV     SI,81H                 ;Advance to first non-space
                CLD
                JMP     SHORT PARSE2

PARSE2:         MOV     BYTE PTR [SI],CR       ;End-of-line?
                JE      INSTALL                ;Yes, then install/enable
                CMP     AL,'/'                 ;Optimize entry
                JNE     PARSE1                 ;Qualifier /U?
                MOV     WORD PTR [SI],0DFFH    ;Yes, then disable program
                JZ      DISABLE                ;Qualifier /U?
                JE      UNINSTALL              ;Yes, then uninstall program

ERROR_EXIT:     PUSH    AX                     ;Error code
                MOV     DX,0FFSET ERRMSG1      ;Error message address
                PUSH    AX                     ;Save registers
                MOV     AH,9                    ;Display prologue
                MOV     DX,0FFSET HEADMSG      ;Display prologue
                MOV     AH,9
                INT     21H

                POP     DX                     ;Display error
                MOV     AH,9
                INT     21H

                POP     AX                     ;Error code
                MOV     AH,4CH                 ;Terminate with ERRORLEVEL set
                INT     21H

;Disable STAYDOWN if a copy is present in memory.

DISABLE:        CMP     INSTALL_FLAG,1         ;Error if not installed
                JE      DISABLE1
                MOV     DX,0FFSET ERRMSG2      ;Initialize error pointer
                JMP     ERROR_EXIT

DISABLE2:       MOV     BYTE DS:[BIOSFLAG],0   ;Clear CHECKFLAG byte
                MOV     DX,0FFSET CONFIRM_MSG1 ;Print confirmation message
CONFIRM_AND_EXIT:
                PUSH    DS
                MOV     AX,CS
                MOV     DS,AX
                MOV     AH,9
                INT     21H

                POP     DS
                MOV     AX,0
                MOV     AH,4CH                 ;Exit with ERRORLEVEL = 0
                INT     21H

;uninstall STAYDOWN if a copy is present in memory.

UNINSTALL:      CMP     INSTALL_FLAG,1         ;Error if not installed
                JE      UNINSTAL2
                MOV     DX,0FFSET ERRMSG3      ;Initialize error pointer
                JMP     ERROR_EXIT
UNINSTAL2:
```

(STAYDOWN.ASM continued)

■ UTILITIES

```
                CALL    REMOVE          ;Uninstall the program
        JNC     UNINSTALL1
                MOV     AL,4
        JMP     ERROR_EXIT
UNINSTALL1:
                MOV     DX,OFFSET UNINST_MSG2  ;Print confirmation message
        JMP     SHORT CONFIRM_AND_EXIT  ;And exit

;install the program if it isn't already installed, or enable it if it is.
INSTALL:
                MOV     ES:[CONFIRM&G],1      ;Get enable byte
        CMP     INSTALL_FLAG,1            ;Branch if not installed
        JNE     INSTALL1
                MOV     DX,OFFSET CONFIRM_AND_EXIT ;And exit
INSTALL1:
                MOV     AX,9CB8H          ;Check for BIOS support of
        INT     15H                      ;extended functions
        JNC     INSTALL2                 ;Branch if support is there
                MOV     AL,716H           ;Use int 9 rather than 15h
        MOV     BX,OFFSET INT9H          ;Point BX to int 9 routine
INSTALL2:
                MOV     AX,35H            ;Save current vector
        INT     21H
                MOV     OLD_VECTOR,BX
        MOV     OLD_VECTOR[2],ES
                MOV     AX,716H           ;Then point to internal
        MOV     DX,OFFSET INTR           ; interrupt handler

                MOV     AX,DS:[2CH]       ;Get environment segment
        MOV     ES,AX                     ; address from PSP
                MOV     AX,49H            ;Then deallocate environment
        INT     21H                       ; space reserved by DOS
                MOV     DX,OFFSET PROGRAM ;Print installation message

                MOV     DX,91000H         ;Terminate but remain resident
        MOV     DX,(OFFSET INITIALIZE-OFFSET CODE+15) SHR 4
```

```
                INT     21H
INITIALIZE:

;REMOVE deallocates the memory block addressed by :
;interrupt vector displayed on installation.

REMOVE          PROC    NEAR
                PUSH    DS
        MOV     AX,35H
                MOV     AL,[BX_VECTOR]    ;Get o
        MOV     BX                       ; vert
                MOV     AX,AX             ; Still
        MOV     BX,ES
                MOV     AX,AX
        CMP     BX,AX
                JE      RELAX
        MOV     DX,OFFSET ERRMSG3
RESTORE_VECTOR:                          ;Restore displaced
                PUSH    DS                ; vector
        ASSUME  DS:NOTHING
                LDS     DX,[BIOS_INS]
                MOV     AX,25H
        MOV     AL,ES:[BX_VECTOR]
                INT     21H
        POP     DS
        ASSUME  DS:CODE
RELAX:
                MOV     WORD PTR ES:[BEGIN]  ;Remove fingerprint
                MOV     AX,49H            ;Free memory given to
        INT     21H                      ; original program block
                MOV     DX,OFFSET ERRMSG4 ;Initialize error output
        RET                              ;Exit with CF intact
REMOVE          ENDP
CODE            ENDS
                END     BEGIN
```

(STAYDOWN.ASM ends)

deinstallation command with "Uninstall Error," you would probably be wise to wrap things up rather quickly, then reboot and start again. This error message indicates that after successfully unhooking itself from one of the keyboard interrupts and thereby effectively disabling itself, STAYDOWN's internal request to deallocate its program memory block has been denied by DOS. Since there's no good reason for DOS to turn the request down, it's best to assume that well-laid plans have gone awry and your data is at risk. And, of course, until you reboot, STAYDOWN will refuse to work.

An important note concerning deinstallations: loading a TSR on top of a still often not-present STAYDOWN from politely removing itself from memory. The resulting hole in memory, while not of catastrophic nature, will never be put to efficient use by DOS's limited memory management kernel. It's sound practice to

never uninstall a TSR that wasn't the last one loaded.

THE ENHANCED KEYBOARD A short refresher on the BIOS keyboard interface, its handling of the family of shift keys, and the problems presented by the

■ The BIOS tracks the Ctrl, Alt, and Shift states in real time by assigning each a bit in low memory.

new look of the 101-key keyboard will make understanding the internals of STAYDOWN easier. The special keys Ctrl, Alt, and Shift are normally treated

differently from the rest in that the BIOS tracks their respective states in real time by assigning each a bit in low memory. The lower 4 bits of the byte at 0040:0017h are dynamically updated to represent the up/down status of the Right Shift, Left Shift, Ctrl, and Alt keys (bit 0 to bit 3, respectively).

The BIOS forces the corresponding bit high when a key is pressed and clears it when a break code (the key's 7-bit scan code with the eighth bit of the byte set to 1) from the keyboard controller signals that the key has been released. A running application program can determine whether or not a given shift key is depressed, either by checking the corresponding data bit directly or by calling interrupt 16h with AH set to 2 to return the BIOS shift status byte in the AL register.

Until the 101-key keyboard was introduced, a single byte in the BIOS Data Area was assigned to record shift key status.

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The addition of duplicate Ctrl and Alt keys required that at least two more bits be dedicated to the shift keys. IBM designated four. Realizing that a press of either or both Ctrl keys should constitute an active Ctrl state, the designers assigned a new bit to each Ctrl and Alt key. The original Ctrl and Alt indicators at offset 17h were now derived by logically ORing the left Ctrl and Alt bits with the right. In this way, not only was compatibility with existing software maintained, but programs written specifically for the new keyboard could determine the state of duplicate keys individually. The diagram "The BIOS Keyboard Status Bytes" illustrates the mapping of the bytes in the BIOS Data Area whose bits reflect shift-key positions.

But there is far more new to the 101-key keyboard than the added keys and re-

■ The Enhanced keyboard offers a choice of three scan code sets. The BIOS was updated to include support for about 45 new key combinations.

shaped numeric keypad. While each key on IBM keyboards has historically been assigned a unique scan code, new keys that duplicate existing ones (including Ctrl and

Alt) are identified by a sequence of two or more scan codes sent from the keyboard controller. Furthermore, the keyboard now offers a choice of three scan code sets. The controller hardware is responsible for translating the incoming scan codes received from the keyboard's dedicated microprocessor into values recognized by the BIOS, much as the original AT keyboard controller did when it converted 84-key keyboard scan codes to their 83-key counterparts. And the BIOS itself was updated to include support for about 45 new key combinations not recognized by earlier versions.

These changes have had a dramatic impact on the way programs are written. Code that needs to detect the new key combinations supported by the BIOS must use a new set of interrupt 16h functions. Func-

```
[BASIC program listing with numbered lines and DATA statements]
```

STAYDOWN.BAS: *A BASIC program that will automatically create STAYDOWN.COM.*

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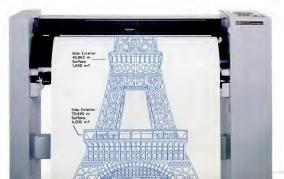
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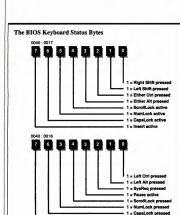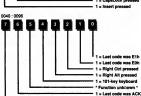
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■ UTILITIES

The BIOS Keyboard Status Bytes

0040 : 0017

```
 7   6   5   4   3   2   1   0
```

```
1 = Right Shift pressed
1 = Left Shift pressed
1 = Either Ctrl pressed
1 = Either Alt pressed
1 = ScrollLock active
1 = NumLock active
1 = CapsLock active
1 = Insert active
```

0040 : 0018

```
 7   6   5   4   3   2   1   0
```

```
1 = Left Ctrl pressed
1 = Left Alt pressed
1 = SysReq pressed
1 = Pause active
1 = ScrollLock pressed
1 = NumLock pressed
1 = CapsLock pressed
1 = Insert pressed
```

0040 : 0096

```
 7   6   5   4   3   2   1   0
```

```
1 = Last code was E1h
1 = Last code was E0h
1 = Right Ctrl pressed
1 = Right Alt pressed
1 = 101-key keyboard
1 = Function unknown *
1 = Last code was ACK
1 = ID sequence in progress
```

A great deal of information on the status of the keyboard is maintained by the BIOS. Each bit acts like a flag, indicating whether a specified condition is met.

tion 0, for example, doesn't report a press of Ctrl–Up Arrow or Ctrl–Down Arrow, while function 10h does. And utilities that monitor incoming scan codes must be alert for the scan code E0h, the first byte of a two-byte sequence that signals the make or break of the enhanced keyboard's new keys.

The Left Ctrl key, for example, generates the make code 1Dh; Right Ctrl generates E0h, then 1Dh. This distinction allows the BIOS to determine which key was pressed and toggle the appropriate shift state bit. Likewise, the Left Ctrl break value is 9Dh (1Dh + 80h), while a break of Right Ctrl is signified by E0h followed immediately by 9Dh.

One unexpected change to the keyboard interface comes from far left field and is nothing less than maddening: the 2-byte make or break code of 13 of the 101 keys is accompanied by an additional two (and sometimes four) scan codes if selected shift keys are simultaneously depressed or if NumLock is on. Pressing the dedicated gray PgUp key, for example, normally produces the make/break codes

```
E0 49 (make)
E0 C9 (break)
```

Pressing the same key with Left Shift held down results in

```
E0 AA E0 49 (make)
E0 C9 E0 2A (break)
```

Holding down Right Shift instead produces

```
E0 B6 E0 49 (make)
E0 C9 E0 36 (break)
```

and pressing and releasing PgUp with both Shift keys depressed sends the convoluted sequences

```
E0 AA E0 B6 E0 49 (make)
E0 C9 E0 36 E0 2A (break)
```

Not by coincidence, the extra scan codes AA/2A and B6/36 correspond to the Left Shift and Right Shift keys, respectively. But the single scan codes that follow the press or release of the Shift keys themselves are external to the sequences above.

This practice departs from IBM's long-standing tradition of leaving make/break codes independent of shift states. As you can see from the listings above, certain

keys transmit different (and lengthier) scan codes sequences if either Shift key is depressed or NumLock is activated. Furthermore, the scan codes AAh and B6h have their high bits set, but come as part of the 1-byte make code of the PgUp key itself. The significance of this is that, until now, you could always differentiate between make and break codes simply by testing bit 7. The new scheme is a radical departure from precedent. It is clearly becoming more desirable than ever to leave keyboard processing strictly to the BIOS if compatibility with future hardware is to be ensured.

KEYBOARD MONITORS TSR pop-up utilities customarily revector interrupt 9 to monitor the keyboard for the press of their hotkey. Interrupt 9 is generated by the keyboard controller on all models of the PC (including PS/2s) whenever a key is pressed or released. This practice has always violated IBM's policy of recommending that programmers deal with the hardware exclusively through the BIOS, but the BIOS, as programmers are all painfully aware, is woefully inadequate.

More recent BIOS versions, however, (including those installed in most ATs, some XTs, and all PS/2 machines) allow programs to monitor scan codes through service 4Fh of interrupt 15h. The current interrupt 9 handler reads a scan code with an IN from the keyboard data port and then, with the scan code in AL, executes an interrupt 15h with AH set to 4Fh. Any TSR caring to examine or even alter these scan codes, therefore, need only tap into interrupt 15h.

It is important to understand the ground rules for using this facility. A program's interrupt 15h handler must first check to be sure that AH is equal to 4Fh on receipt and pass it on to the BIOS handler if it's not. Control is passed back to the BIOS from function 4Fh with the simple execution of a RET 2 instruction. RET 2 (to execute a far return and discard 2 bytes from the stack) is necessary because upon return the BIOS takes action based upon the value of the carry flag. An IRET, you'll remember, performs a far jump and places the word on the stack in the microprocessor's flags register, preserving the state of the flags through the interrupt handling process but preventing the handler from returning values in the flags.

If the carry flag is set on return from a program's interrupt 15h code, the BIOS processes the scan code as usual. A resident utility can alter the scan code by replacing the scan code passed to it in AL with its own scan code. It follows, then, that AL must normally be preserved if we don't wish to affect keyboard operation. The BIOS can be told to ignore the scan code altogether (under the assumption that the intervening handler did the processing for it) by passing control back to it with the carry flag clear.

STAYDOWN uses this new feature on systems that support it and falls back on interrupt 9 for those that don't. The way to determine whether or not the support is there is to call interrupt 15h with AH set to C0h. If the carry flag is clear on return (a

> ■ It is becoming more desirable than ever to leave keyboard processing strictly to the BIOS if compatibility with future hardware is to be ensured.

condition we can test with JNC or JC), function 4Fh is supported; if the carry flag is set, support is lacking.

For keys that return multiple scan codes, the BIOS calls interrupt 15h for each one so that the data stream can be monitored completely. When STAYDOWN wants a system that is equipped to service function 4Fh to ignore the release of a shift key, it clears the carry flag and exits. If a break code is to be passed by a system in which interrupt 9 has been intercepted instead, STAYDOWN must manually reset the keyboard and signal the interrupt controller that processing is complete, enabling other system interrupts of equal and lower priorities. The ten lines of code following the label RESET_KEYBOARD in the source listing illustrate exactly how this is accomplished.

If you're coding an interrupt service routine in assembler and plan to exit with a RET rather than with an IRET, you must define the body of the routine as a FAR procedure. Near returns reset the IP register only, leaving CS unaltered, while far returns cross segment boundaries by replacing both CS and IP with values pushed onto the stack. Whether a procedure is defined as FAR or NEAR is irrelevant if IRET is used, since returns from interrupts are far by definition.

The procedures INT9H and INT15H, built to service interrupts 9 and 15h, respectively, are both defined with the assembler directive PROC FAR. If you've wondered why programmers have to bother with NEAR and FAR keywords in procedure declarations, look no further: it's to let the assembler know whether to code a RET mnemonic as a near or far return. Although Microsoft's Macro Assembler has traditionally offered only one RET (a generic one whose type is determined by declaration), the 8088 hardware offers two. Among the many improvements in MASM 5.0 is the option of extending RET to RETN or RETF, for RETurn Near or RETurn Far.

A LOOK INSIDE Once STAYDOWN has latched onto one of the keyboard interrupts to monitor scan codes, it invokes the procedure MAIN to process them. MAIN simply passes make codes through, storing their value for comparison with the next break code to determine whether the key was released immediately after being pressed. If the break matches the make and the key was one of the shift keys, the break is intercepted by STAYDOWN and a flag is set indicating that a false shift state is in effect. MAIN resolves the shift state upon receipt of the next break by zeroing the bit or bits that correspond to the shift key active.

STAYDOWN ORs each make code with the byte EQ_FLAG (which contains 0 if the last scan code was not E0h, or E0h if it was) before storing it away. A press and release of the Right Ctrl or Alt key is made distinct from the press or release of Left Ctrl or Alt, since a make from the right-hand side of the keyboard will have its high bit set after STAYDOWN ORs it with

■ UTILITIES

STAYDOWN BY MODEM

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If you use the Xmodem protocol, you can download STAYDOWN.COM directly, saving typing or downloading either the .BAS or the .ASM version. STAYDOWN.BAS, whether entered from the magazine at your keyboard or downloaded from PC-IRS, will automatically create STAYDOWN.COM when run once in BASIC. STAYDOWN.ASM, also listed both here and on PC-IRS, allows you to modify the program but requires you to use a macro assembler (IBM or Microsoft, Version 2 or later) and the following commands:

```
MASM STAYDOWN;
LINK STAYDOWN;
EXE2BIN STAYDOWN STAYDOWN.COM
```

Photocopy this page. Trim and hole-punch the copy and add it to your DOS manual.

STAYDOWN Command

Jeff Prosise   1988 No. 8 (Utilities)

Purpose: Permits entering two-key Ctrl-, Alt-, and Shift-key combinations as separate keystrokes.

Format: STAYDOWN [/D] [/U]

Remarks: The relocation of the function keys on IBM's "Enhanced" 101-key keyboard makes it impossible to hold down a shifting key (Ctrl, Alt, Shift) and press a key simultaneously with one hand. Even with the 83-key (PC and XT) and 84-key (original AT) keyboards, many shifting key combinations have been awkward for many users and sometimes impossible for the physically handicapped. STAYDOWN is a terminate-and-stay-resident (TSR) utility that permits (but does not require) the shifting key to be physically released while remaining logically depressed until the key it is to affect is struck.

The optional /D switch deactivates STAYDOWN until the command is entered again without the switch. The optional /U switch uninstalls the program and frees the memory it previously occupied. If another TSR program that uses the same interrupt vector has been loaded after STAYDOWN, a "Cannot Uninstall" message will be displayed. If the message "Uninstall Error" appears, users should immediately save their work and reboot.

If a shifting key is mistakenly hit (and held down by STAYDOWN), just hit the key again to disengage it. With STAYDOWN loaded, users can choose to pop up the *SideKick* utility either by holding down the Ctrl key and pressing/releasing the Alt key or by pressing/releasing the Ctrl key followed by pressing/releasing the Alt key. Note, however, that as its action is confined to the *next* keystroke, three-key combinations such as Ctrl-Alt-Del must be entered conventionally.

STAYDOWN can be entered either at the DOS command line or, preferably, as a line in an AUTOEXEC.BAT file. It should be loaded before *SideKick*. While compatible with most applications, full compatibility with all applications cannot be guaranteed by any TSR program.

(side tab: Commands)

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80h. STAYDOWN strips the high bit from a break code and ORs it with EO_FLAG before comparing it with the last make code. This procedure ensures that a Left Ctrl make followed sequentially by a Right Ctrl break won't fool the program into locking the Ctrl state.

The interrupt 9 and 15h handling routines invoke MAIN identically, but procedure INT15H does a bit of preprocessing before calling MAIN. It interprets E0h codes and processes them externally by setting a flag indicating the last code was of that value. It also hides the first 2 bytes

UNINSTALLING STAYDOWN attempts to uninstall itself when run with the /U parameter. Deinstallation is a simple matter of restoring the sole interrupt vector STAYDOWN altered during its initializa-

tion, then deallocating the area of memory it occupies for use by other programs.

The only hitch arises if another TSR has grabbed the same interrupt STAYDOWN borrowed, thus making STAYDOWN an

> ■ On keyboards with
> one Ctrl and Alt key,
> MAIN can toggle the
> Ctrl or Alt state off.

of a 4-byte make sequence and the last 2 of a 4-byte break (for the first and last 4 of a 12-byte make/break). This prevents special make codes greater than 80h from being interpreted by MAIN as breaks.

On keyboards that have only one Ctrl key and one Alt key, MAIN can toggle the Ctrl or Alt state off by zeroing bit 2 or 3 of the primary shift state byte at 0040:0017. But if there are two of each, the respective bit can only be reset if the two bits representing both Left and Right Ctrl or Alt are also zero. When MAIN attempts to resolve an ignored break of Ctrl or Alt that is not preceded by the scan code E0h (this can come either from the Left Ctrl or Alt on an Enhanced keyboard or from the single Ctrl or Alt on an 83- or 84-key keyboard), MAIN must determine the type of keyboard before it can restore normal operation.

Making that determination is easy. Bit 4 of the third keyboard data byte at 0040:0096 is set to 1 by the PC's power-on routines if a 101-key keyboard is connected, or 0 if anything else is attached. The machine code instruction

```
TEST ES:[SHIFT_STATE_3],10H
```

clears the microprocessor's zero flag if an Enhanced keyboard is detected.

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intermediate link in the interrupt vector chain. In this event, removing STAY-DOWN would leave that vector pointing to unallocated space. The free memory is almost certain to be claimed and corrupted by another process or by DOS itself. And when the targeted interrupt is next generated (guaranteed to occur when you next strike a key, if not before), the system will come crashing down.

To prevent such a catastrophic occurrence, STAYDOWN verifies that the interrupt vector it replaced hasn't changed since installation by comparing the segment the vector currently addresses with

■ *SideKick* contains some now infamous code that periodically checks that another TSR hasn't stolen interrupt 9 away.

the segment in which the code was installed. If it has changed, a warning message is issued, and the removal process is aborted harmlessly before STAY-DOWN's memory space is deallocated.

There are even instances when STAY-DOWN can't remove itself even though it was the last TSR loaded. If you're using a PC that lacks the extended interrupt 15h facilities, for example, and you loaded *Side-Kick* before running STAYDOWN, STAYDOWN will report that it cannot be uninstalled. The reason is that *SideKick* contains some now infamous code that takes over interrupt 9 (the interrupt STAY-DOWN taps into if it can't use interrupt 15h). The *SideKick* code periodically checks (using the services of the timer interrupt) that another TSR hasn't stolen interrupt 9 away. *SideKick* does this to ensure that it has first crack at the keyboard interrupt. If STAYDOWN has revectored interrupt 9 to itself, *SideKick* jealously grabs it right back. STAYDOWN will still function properly since *SideKick* has at least the good grace to share the interrupt, but it won't attempt to uninstall itself when

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it senses that the vector has changed.

Since STAYDOWN discards the environment block it inherited from DOS before making itself resident, the only block left to free in the deinstallation process is the one given to its PSP and code segment. Deallocation is accomplished with DOS service 49h. The function is invoked through interrupt 21h with the segment address of the block to be freed in ES. DOS should *not* deny the request unless its chain of memory control blocks has been cor-

■ **STAYDOWN shows one method a programmer might devise to alter the keyboard's behavior.**

rupted. If the system returns with the carry flag set, indicating the deallocation attempt failed, STAYDOWN responds by warning you of an "Uninstall Error."
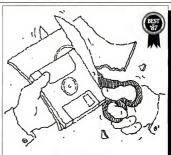
IN CLOSING STAYDOWN illustrates only one of many methods a programmer might devise to alter the behavior of the keyboard. For example, KBX.COM, the utility presented in PC Lab Notes, September 29, 1987, turned the NumLock and ScrollLock keys into auxiliary shift keys used to access upper-order ASCII characters. With the services of interrupt 15h available to let a utility monitor communications between the on-board keyboard controller and the system BIOS, redefining the entire keyboard layout would entail little more than pulling a new scan code value from a lookup table, then passing it to the BIOS in AL with the carry flag set.

The natural evolution of PC hardware and the problems associated with keeping software compatible with all generations pointedly illustrate why programs should delve no lower than the BIOS level (or preferably, the operating system level) when possible. The functions added to interrupt 15h (which originally served as the BIOS cassette port interface) help programmers write well-behaved code that should be directly portable to future sys-

tems. The advent of OS/2—a real programmers' operating system—should spell the end of the days when utilities like STAYDOWN are forced to swipe interrupts and other system facilities to gain ac-

cess to data streams they have every right to examine.

Jeff Prosise is a contributing editor of PC Magazine.

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In the last issue, I broke the good news that if you have IBM's OS/2 Standard Edition 1.0 and Microsoft's Macro Assembler 5.0, you have all the software you need to begin writing assembly language programs for OS/2. In this column, I'll make good on my promise to demonstrate exactly how this can be done.

Let's take a look at a sample program. WAKEUP.ASM is the assembly language version of a C program I described in an earlier Environments column (*PC Magazine*, December 22, 1987).

To run WAKEUP.EXE, you enter the following command line under OS/2:

DETACH WAKEUP hour:minute

DETACH is an OS/2 internal command that runs the program that follows (in this case, WAKEUP) in the background. When you enter the command line shown here, the OS/2 prompt returns but WAKE-UP will be running. You can load multiple copies of WAKEUP if you want.

WAKEUP resides quietly in the background until the time specified on the command line. WAKEUP then interrupts whatever you're doing and displays an urgent little message ("WAKE UP! WAKE UP! WAKE UP!"). The screen alternates

```
        .286C
        DOSSEG
        .MODEL SMALL
        .STACK #200h

; OS/2 External Functions and Data Structure

        EXTRN   DosBeep:FAR, DosExit:FAR, DosGetInfoSeg:FAR
        EXTRN   DosSleep:FAR, DosWrite:FAR, KbdCharIn:FAR
        EXTRN   KbdFlushBuffer:FAR, VioEndPopUp:FAR, VioPopUp:FAR
        EXTRN   VioWrtCurPos:FAR, VioWrtTAttr:FAR, VioWrtTTY:FAR

DateTimeStruc   STRUC
                hour            db      ?
                minutes         db      ?
                seconds         db      ?
                hundredths      db      ?
                day             db      ?
                month           db      ?
                year            dw      ?
                timezone        dw      ?
                day_of_week     db      ?
DateTimeStruc   ENDS

KeyDataStruc    STRUC
                char_code       db      ?
                scan_code       db      ?
                status          db      ?
                nls_shift       db      ?
                shift_state     dw      ?
                time            dw      ?
KeyDataStruc    ENDS

        .DATA                           ; Initialized Data Segment

SystemMsg       db      13, 10, "System: DETACH WAKEUP hour:minute"
                db      13, 10, 10, 9,  "Use 24-hour time format."
                db      13, 10, 10, "(c) 1988, Ziff Communications Co."
                db      13, 10,     "PC Magazine 274, *Charles Petzold"
                db      13, 10
```

(continues)

WAKEUP.ASM: *The assembly language source code to create WAKEUP.EXE, a sample OS/2 program that interrupts you at a specified time with a flashing, beeping message. Note that this program requires Microsoft MASM 5.0.*

■ ENVIRONMENTS

between white-on-red and red-on-white and WAKEUP beeps the PC's speaker in an annoying manner. Pressing any key allows you to return to your work.

(A warning: if you are absorbed in doing something on your PC when WAKEUP sets off the alarm, it can give you a frightening jolt and destroy your concentration, to say nothing of possible damage to your heart.)

WAKEUP calls 12 OS/2 functions. All of these are listed at the top of the program in EXTRN statements. The function names have prefixes that indicate their general category ("Kbd" stands for keyboard and "Vio" stands for Video I/O). The DosGetDateTime and KbdCharIn functions both use structures for passing information between OS/2 and the program. These structures are also defined near the top of the program. The rest of the software development kits from IBM and Microsoft will probably supply "include" files to conveniently define these external functions and OS/2 structures so you don't have to.

CREATING WAKEUP.EXE To create WAKEUP.EXE from the WAKEUP .ASM file, you need Microsoft Macro Assembler 5.0, and the LINK.EXE program

■ If you are absorbed in doing something on your PC when WAKEUP sets off the alarm, it can give you a frightening jolt.

and DOSCALLS.LIB file included with IBM's OS/2 Standard Edition 1.0. You execute these two commands:

```
MASM WAKEUP ;
LINK WAKEUP /ALIGN:16 , , DOSCALLS ;
```

Since you have to run MASM.EXE in DOS Compatibility Mode, it's most con-

venient to run LINK.EXE in DOS Mode also.

The PATH string in your DOS Mode environment should be set up so that the directory containing the OS/2 version of LINK.EXE is listed before any directory that contains a DOS version of LINK .EXE. Suppose, for example, that you keep MASM.EXE in a directory named MASM5. This directory probably also contains one of the many DOS versions of LINK.EXE. After installation of OS/2, the OS/2 version of LINK.EXE is stored in the \OS2 directory. In such a case, the PATH statement in your AUTOEXEC.BAT file should be arranged something like this:

```
PATH = C:\OS2; C:\MASM5;
```

If you've moved LINK.EXE to a directory named \OS2\PRG (as I suggest in this issue's PC Lab Notes), then your PATH statement should look like this:

```
PATH = C:\OS2\PRG; C:\MASM5; ...
```

The LIB string in your DOS Mode environment should include the directory

```
Je          SkipDelim           ; If match, try another byte
                                 ; Calculate hour
            Cell    NumberTrans  ; Translate ASCII byte
            Mov     DH, AH       ; Save first 'hour' byte in DH
            Lodsb                ; Get second 'hour' byte
            Cmp     AL, ':'      ; See if it's a colon
            Je      GotHour      ; If so, hour is finished
            Call    NumberTrans  ; If not, translate it
            IMul    DH, 10       ; Multiply first byte by 10
            Add     DL, AL       ; Add the second byte
            Cmp     DL, 24       ; Check if hour is 24 or above
            Jae     ParamError   ; What clock do you use?
            Lodsb
            Cmp     AL, ':'      ; Next byte
            Jnz     ParamError   ; should be colon
                                 ; If not, it's an error
GotHour:    IMul    DH, 60       ; Calculate minutes
                                 ; First 'minutes' byte
            Lodsb                ; Translate it
            Call    NumberTrans
            IMul    AL, 10       ; Multiply by 10
            Mov     AH, AL       ; And save in AH
            Lodsb                ; Second 'minutes' byte
            Call    NumberTrans  ; Translate it
            Add     AH, AL       ; Add the two
            Cmp     AL, 60       ; If minutes 60 or above > 60
            Jae     ParamError   ; Another bizarre clock
            Sub     AX, AX       ; Zero out AX
            Mov     DH, AH       ; Save time in minutes
                                 ; All done with parsing
  Display 'syntax' message if an error is encountered
ParamError: Push    ES           ; Point DS to
            Pop     DS           ; data segment
            Mov     CX, SyntaxMsgLen ; Length of text

WriteSyntaxMsg: Push  1          ; Handle is standard error
                Push    0        ; Segment of text
                Push    Offset SyntaxMsg  ; Offset of text
                Push    CX       ; Length of text
                Push    0        ; Segment of bytes written
                Push    Offset BytesWritten ; Offset of bytes written
                Call    DosWrite ; Write the error message
                Cmp     AX, SyntaxMsgLen ; Check if second time through
                Je      EndPopup ; No wait, hit keystroke
                Cmp     AX, AX   ; If no error, simply exit
                Jne     ErrorExit
EndPopup:       Push    0        ; Segment of PopupFlag
                Push    Offset PopupFlag  ; Offset of PopupFlag
                Call    VioPopup ; Handle always zero
                Call    VioPopup ; Popup on screen

                Cmp     AX, SyntaxMsgLen2 ; Test length for popup version
                Jmp     WriteSyntaxMsg    ; Go to it

                Push    0        ; Segment of KeyData area
                Push    Offset KeyData    ; Offset of Keydata struc
                Push    0        ; Wait for keystroke
                Push    1        ; Keyboard handle
                Call    KbdCharIn ; Patch a key

                Push    0        ; Video handle
                Call    VioEndPopup ; End the popup
ErrorExit:      Push    1        ; Terminate all threads
                Push    1        ; Return error code of 1
                Call    DosExit  ; End it!

NumberTrans Subroutine--Translates ASCII to Hex (or set if error)
NumberTrans: Sub    AL, '0'      ; ASCII to hex
             Jc     ParamError   ; error if under 0
             Cmp    AL, 9        ; Also error if over 9
             Ja     ParamError
             Ret

BadNumberTrans: Ret

  Get current time, calculate difference, and go to sleep
GetCurrentTime: Push  ES         ; Restore DS to data segment
```

(WAKEUP.ASM continues)

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■ ENVIRONMENTS

containing DOSCALLS.LIB. After you install OS/2, install it into its \OS2 directory. So, your AUTOEXEC.BAT file contains a statement like

    SET LIB = ... C:\OS2; ...

or, if you have no other directories containing .LIB files,

    SET LIB = C:\OS2

Again, if you don't have MASM 5.0, you can still create WAKEUP.EXE by typing the WAKEUP.BAS listing shown into the OS/2 version of BASICA (which runs only under DOS Compatibility Mode, unfortunately) and running the program. Even if you don't have OS/2 yet, you can still create WAKEUP.EXE using your DOS version of BASICA. WAKEUP does not run under DOS, but at least you'll have an

OS/2 utility program ready to use when you eventually install OS/2 on your system. That way, when someone pontifically observes, "OS/2 is worthless unless you

■ Even if you don't have OS/2 yet, you can still create WAKEUP.EXE using your DOS version of BASICA.

have OS/2 programs," you can come back with, "But I already do have one." [We'll put the program on PC-IRS, as well.—Ed.]

HOW WAKEUP WORKS WAKEUP begins by reading the time specified on the command line. That time is then translated

into the number of minutes since midnight. The program then calls DosGetDateTime to get the current time, takes the difference between the two times, and converts the result to milliseconds. After pushing the number of milliseconds on the stack, WAKEUP then calls DosSleep. DosSleep suspends a program for the specified period of time.

WAKEUP must sound the alarm when the DosSleep call returns control to it. The program's first move is to use VioPopUp to get control of the screen and keyboard. (This is the only way a detached program can write to the screen.) WAKEUP then uses VioWrtTTY to write the message, VioWrtNAttr to change the attribute (color) of the screen, and DosBeep to beep the speaker. During this flashing and beeping, WAKEUP checks if a key has been pressed by calling KbdCharIn. If so, the program calls VioEndPopUp to restore the screen that it interrupted. The program then terminates normally.

Programs similar to WAKEUP are also possible under OS/2. A DOS alarm pro-

```
                    Pop     DS                      ; Restore segment address
        Push    Offset DateTime         ; Push offset of structure
        Push    3                       ; Get current date/time
        Call    DosGetDateTime          ; Sound alternate time

        Mov     AX, DateTime.hour       ; AL is current hour
        Sub     AX, AB                  ; Zero out top byte
        Imul    AX, AX, 60              ; AX is minutes since midnight
        Add     AL, DateTime.minutes    ; Add the current minutes
        Adc     AX, 0                   ; And carry into top byte

        Xchg    AX, DX                  ; Subtract parameter time
        Mov     AX, DX                  ; From current time
        Jnc     DifferenceOK            ; Or if both after midnight

        Mov     AX, 24 * 60             ; Otherwise add whole day

DifferenceOK:   Mov     DX, 60 * 1000           ; Milliseconds in 1 minute
        Mul     DX                      ; DX:AX = interval in msec

        Push    DX                      ; Push high word
        Push    AX                      ; Push low word
        Call    DosSleep                ; And take a long long nap

; on return from DosSleep, start beeping and flashing

                    Push    AX                      ; Segment of flag
        Push    Offset PopupFlag        ; Offset of flag
        Push    VioPopUp                ; Say alarm is always
        Call    VioPopUp                ; Pop up!

        Mov     AX, 80                  ; 80 column screen screen
        Sub     AX, WakeupMsgLen        ; Less the length of message
        Sar     AX, 1                   ; Divide by two for margin

        Push    12                      ; Row (near the center)
        Push    AX                      ; Column to center text
        Push    0                       ; Video handle
        Call    VioSetCurPos            ; Now move cursor position

        Push    Offset WakeupMsg        ; Segment of message
        Push    WakeupMsgLen            ; Offset of message
        Push    0                       ; Length of message
        Call    VioWrtTTY               ; Write it out

FlasherLoop:    Mov     AX, 0                   ; Flush keyboard buffer
        Push    AX                      ; in case user is typing
        Mov     BX, 512                 ; Indicates 1st attribute
        Mov     AX, 1024                ; One alternating tone
        Mov     DX, 1024                ; Second alternating tone
```

```
                    Call    Ringbell                ; Start it going

        Mov     AL, 1                   ; Second attribute
        Mov     DX, 1024                ; One alternating tone
        Mov     AX, 1024                ; Second alternating tone
        Call    Ringbell                ; Do it again

        Push    AX                      ; Segment of ReyData struc
        Push    Offset KeyData          ; Offset of KeyData struc
        Push    0                       ; No wait for keystroke
        Push    0                       ; Keyboard handle
        Call    KbdCharIn               ; Fetch a key

        Mov     AX, KeyData.char_code   ; Check if character and scan
        Or      AL, KeyData.scan_code   ; code are both zero
        Jz      FlasherLoop             ; If so, no key, so continue

        Push    0                       ; Video handle
        Call    VioEndPopUp             ; End the popup

        Push    1                       ; Terminate normally
        Push    0                       ; With return code for success
        Call    DosExit

; Ringbell Subroutine--beeps attribute from AX, beeps with DX and DX

Ringbell:       Add     AX, Offset Attribute    ; Attribute for screen

        Push    AX                      ; Segment of attribute
        Push    0                       ; Offset of attribute
        Push    25 * 80                 ; Number of attributes
        Push    0                       ; Starting row
        Push    0                       ; Starting column
        Push    0                       ; Video handle
        Call    VioWrtNAttr             ; Write the attribute

        Mov     CX, 10                  ; Do beeps ten times

Ringbell1:      Mov     AX, 1                   ; Frequency
        Push    50                      ; Duration
        Call    DosBeep                 ; Beep

        Mov     AX, 1                   ; Frequency
        Push    50                      ; Duration
        Call    DosBeep                 ; Beep

        Loop    Ringbell1               ; Loop around

        Ret

        END     Entry
```

(WAKEUP.ASM ends)

■ ENVIRONMENTS

gram would have to remain resident in memory and intercept interrupt 8, the hardware timer tick interrupt. At each timer tick, the program would decrement a counter until it reached zero. The code is not very complex, but nothing close to the simplicity of DosSleep.

After setting off the alarm, a well-done DOS version of WAKEUP would terminate and remove itself from memory. Under DOS, however, this would leave a small hole in memory if other RAM-resident programs had been loaded after WAKEUP.

Under OS/2, by contrast, memory holes are inconsequential. Because programs access memory using virtual selectors rather than physical segment addresses, OS/2 can move program code and data segments around in memory to consolidate free memory space and eliminate the holes.

DYNAMIC LINKING The mechanics of creating WAKEUP.EXE from WAKEUP.ASM are not very different from those creating a DOS assembly language pro-

```
100 REM--BASIC PROGRAM TO CREATE WAKEUP.EXE
110 OPEN "WAKEUP.EXE" AS #1 LEN = 1
120 FIELD #1,1 AS A$
130 FOR I% = 1 TO 9
140 FOR J% = 1 TO 70
150   LINES%=I% * 8
160   FOR J% = 1 TO 8
170     READ BYTES
180     LINESUM = LINESUM + BYTES%
190     LSET A$ = CHR$(BYTES%)
210   PUT #1
220   NEXT J%
230   READ LINECHECK
240   IF LINECHECK <> LINESUM THEN PRINT "Error in Line:" 100 + 10 * I%
250 NEXT I%
260 CLOSE
270 IF CHKSUM% = 71523 THEN PRINT "Successful Completion!" : END
280 PRINT "Sum file is not valid!" : END
290 DATA ...
```

(The remainder of the listing consists of numbered DATA statements containing the byte values used to build WAKEUP.EXE.)

WAKEUP.BAS: *If you lack the knack to assemble, type in and execute this BASIC program that will automatically create the OS/2 demo program WAKEUP.EXE, which resides in the background until a specified time.*

gram. The only real oddity is that the DOSCALLS.LIB file must be specified as a LINK parameter.

DOSCALLS.LIB is an "import library" for OS/2 function calls. An import library is structured very much like the normal object code library programmers often use to store useful subroutines. When a program contains references to external functions, LINK searches the object code libraries for these functions and adds them to the .EXE file.

But an import library contains no code. Instead, the entries in the import library allow LINK to identify calls to OS/2 functions within a program and to construct tables in the .EXE file that reference these calls. OS/2 later uses these tables to link the function calls to the actual functions. This linking occurs when the program is run, which is why it's called "dynamic linking."

For example, WAKEUP.ASM contains a far call to the VioSetCurPos function to set the cursor position. At the top of WAKEUP.ASM the function is defined as an external far function. The assembler generates code for a far call to VioSetCurPos but leaves the address of the VioSetCurPos function unresolved in the

■ An import library is
structured very much like
the normal object code
library programmers often
use to store useful
subroutines.

WAKEUP.OBJ file.

When you run LINK to create the WAKEUP.EXE file, LINK searches DOSCALLS.LIB to find a reference to VioSetCurPos. The information in DOSCALLS.LIB indicates that this function is actually contained in the VIOCALLS dynamic link module. LINK adds this information to the WAKEUP.EXE file, but it still leaves the call to VioSetCurPos unre-

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■ ENVIRONMENTS

solved. To WAKEUP.EXE, the VioSet-CurPos function is said to be "imported."

When you run WAKEUP.EXE under OS/2, OS/2 loads the program into memory and looks in the .EXE file to determine what imported functions it references. One

■ The process of dynamic linking is generalized in OS/2 and allows the operating system to be easily expanded and enhanced.

of them is VioSetCurPos, which is located in the VIOCALLS dynamic link module. This is the file VIOCALLS.DLL, one of the many files that make up OS/2. The VioSetCurPos function is said to be "exported" from VIOCALLS.

Because WAKEUP contains a call to VioSetCurPos, OS/2 allocates a block of memory for the VIOCALLS.DLL code segment that contains the VioSetCurPos function. The address of the function in VIOCALLS is then inserted into WAKEUP's call to the function. Thus, when WAKEUP is running and calls the VioSetCurPos function, control passes directly to the VIOCALLS module without any intermediary code.

This process of dynamic linking is generalized in OS/2 and allows the operating system to be easily expanded and enhanced. For example, the Presentation Manager component of OS/2 1.1 will be little more than a set of new dynamic link libraries.

EXPLORING THE .EXE FILE As you might expect, support of dynamic linking means that the format of OS/2 .EXE files must be somewhat more complex than that of DOS .EXE files. In my next column we'll explore OS/2 .EXE files by writing a simple OS/2 hex dump program and dumping the contents of .EXE and .DLL files.

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■ **POWER PROGRAMMING** ■ RAY DUNCAN

THE POWER PROGRAMMING LIBRARY

Using the /ZI option to create your own Power Programming library of MASM procedures and subroutines; and some pressing questions answered.

The "Power Programming Library" table printed here lists the assembler code procedures and subroutines that have been published in the first ten Power Programming columns. *If you're missing any issues, the files can be downloaded by modem from the PC Magazine Interactive Reader Service.—Ed.*] If you haven't done so already, you should assemble all of the subroutines and place them in a library called PP.LIB. Figure 1 shows the commands needed and the library response. We'll be using these routines, and others yet to be published, extensively during the coming year.

Use of the /ZI switch, as shown in Figure 1, causes MASM to place certain debugging information into the object module. This debugging information can be used by Microsoft's *CodeView* to display the source code associated with the machine code while you are debugging. Although it causes the final executable (.EXE) file for your program to be somewhat larger, use of the /ZI switch does not increase a program's runtime memory requirements—the debugging information sits at the very end of the .EXE file and is not loaded into memory by the normal MS-DOS program loader.

ERRATA In the program SHOWENV .ASM, which was published on page 352 of the January 12, 1988, issue, the closing single-quote marks (') somehow got dropped during the production process on the lines labeled msg1 and msg2 in segment _DATA.

The comments for the ITOA.ASM and

LTOA.ASM routines, published in the Power Programming column of February 29, 1988, stated that the buffers that will receive the converted ASCII string (pointed to by registers DS:SI) should be at least 6 and 11 bytes long, respectively. This is true enough for any radix of ten or greater. However, if you wish to use a lower radix with these conversion routines, you should provide appropriately longer buffers. For example, in the extreme case, where you are converting to ASCII strings with a radix of two, you should provide a 16-byte buffer for ITOA and a buffer of 32 bytes for LTOA.

In the January 26, 1988, issue there are three errors in the next-to-last paragraph of page 322 (the paragraph beginning, "Next, it determines. . . ."). The two references to GETENV in this paragraph should have been to GETENV. In the address SP:002CH should have been PSP:002CH (i.e., offset 002CH from the beginning of the program segment prefix).

POWER PROGRAMMING MAIL *PC Magazine* readers are a friendly and communicative bunch. Since this column started, I have been receiving three to five e-mail messages and letters a day with sug-

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Power Programming Library

Name	Function	Issue
ARGC.ASM	Count command line arguments	Dec. 22, 1987
ARGV.ASM	Get address of command line argument	Dec. 22, 1987
GETENV.ASM	Get address of environment string	Jan. 12, 1988
PUTENV.ASM	Add string to environment	Jan. 26, 1988
ATOI.ASM	Convert ASCII to 16-bit integer	Feb. 16, 1988
ATOL.ASM	Convert ASCII to 32-bit integer	Feb. 16, 1988
ITOA.ASM	Convert 16-bit integer to ASCII	Feb. 29, 1988
LTOA.ASM	Convert 32-bit integer to ASCII	Feb. 29, 1988
LCVT.ASM	Formatted-binary-to-ASCII conversion	Apr. 12, 1988
HTOL.ASM	Convert hex ASCII to 32-bit integer	Apr. 12, 1988

The general-purpose MASM subroutines and procedures that have been published in Power Programming columns, and where to find them.

■ POWER PROGRAMMING

gestions, questions, and comments about the column and its programs. Here is a selection from among those of general interest, together with my answers. [As these letters were posted electronically, the correspondents' city and state of residence are not indicated.—Ed.]

B-TREES IN C

I am trying to learn C programming via the infamous bootstrap method; I am using Turbo C. My current problem has to do with creating B-tree/ISAM files. I need help with the nitty-gritty code, not with abstract generalities. I want to create files that will provide random access to elements of data. I also need help with reading and writing into and out of these files. I have about a dozen books on C and data structures, none of which help.

Frank Beer

Management of B-tree indexed files is a complex subject. There are a number of good commercial library packages avail- able to do the job, such as Btrieve, from Softcraft, and c-tree, from FairCom. Programmer's Connection, a well-respected mail-order distributor (tel.: (800) 336-1166), lists over 100 C utility and library packages in its catalog, many of which provide you with functions for indexed file access.

Of course, if you really want to write your own B-tree indexed file management routines, the necessary research into B-tree techniques will be both interesting and educational. A good starting point is the venerable book Algorithms + Data Structures = Programs, *by Niklaus Wirth, published by Prentice-Hall. You should be able to find it in any good technical or college bookstore.*

The main question, which only you can decide, is whether you have time (and can afford) to reinvent the wheel, or whether your time would be more efficiently spent if you buy someone else's library and concentrate your efforts on the design of your application and its user interface.

WHICH C COMPILER?

I need to buy a C compiler, and my budget points me toward either Quick C or Turbo C. My impression is that Turbo C may be faster, more optimizing, and may offer more to the experienced user, while Quick C may offer more features for the beginner (like me), such as its on-line help and debugging environment. Any feelings on this? Should I shop only on price? Which compiler has better documentation?

Second, will my old Microsoft MASM, Version 1.25, work for the preliminaries, or should I file it with my old WordStar?

John Intorcio

The MASM question is easy to dispose of: update that rascal as soon as possible! The current versions of MASM are several times faster and more powerful than the version you are using, the documentation has improved immensely, and MASM 5.0 now comes with CodeView—Microsoft's nifty window-oriented mixed-language debugger.

Which C compiler to get is a tougher call. I happen to like the Turbo C user interface a lot better than Quick C: it's more visually attractive, the key assignments are more intuitive, the error window shows you more than one error at a time, and so forth. The only (minor) factor weighing against Turbo C in this area is its complete lack of mouse support.

So far as generating code goes, I have not been convinced that either compiler offers any great advantage over the other. Quick C's graphics library, debugger, and compatibility with Microsoft C 5.0 would probably carry the day here. Borland is promising a Turbo C debugger "real soon now," but since Borland's compiler technology is acquired rather than internally developed (Turbo C is actually a repackaging of Wizard C, for example, and Turbo Pascal appears to be derived directly from a European compiler called COMPAS Pascal), it's hard to know whether it can deliver on this promise in a timely fashion.

As for documentation, the Turbo C manuals are comparatively weak, except for one very nice section designed for the Turbo Pascal programmer who is trying to learn C. The Turbo runtime library man-

```
C>MASM /ZI ARGC;   <Enter>
C>MASM /ZI ARGV;   <Enter>
C>MASM /ZI GETENV; <Enter>
C>MASM /ZI PUTENV; <Enter>
C>MASM /ZI ATOI;   <Enter>
C>MASM /ZI ATOL;   <Enter>
C>MASM /ZI ITOA;   <Enter>
C>MASM /ZI LTOA;   <Enter>
C>MASM /ZI LCVT;   <Enter>
C>MASM /ZI HTOL;   <Enter>
C>LIB   <Enter>

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Library name: PP   <Enter>
Library does not exist.   Create? Y   <Enter>
Operations: +ARGC &   <Enter>
Operations: +ARGV &   <Enter>
Operations: +GETENV &   <Enter>
Operations: +PUTENV &   <Enter>
Operations: +ATOI &   <Enter>
Operations: +ATOL &   <Enter>
Operations: +ITOA &   <Enter>
Operations: +LTOA &   <Enter>
Operations: +LCVT &   <Enter>
Operations: +HTOL   <Enter>List file:   <Enter>

C>
```

Figure 1: *Building the library PP.LIB. The /ZI switch causes MASM to include debugging information for CodeView in the resulting object file.*

■ POWER PROGRAMMING

ual is poorly organized and doesn't come within light years of the Microsoft documentation. Microsoft has poured enormous effort into upgrading its documentation over several generations of their mainline Microsoft C compiler, and the Quick C manuals have really benefited from this effort.

WRITING TSRs

I have a problem with a TSR program I'm writing as an experiment. I'm using MASM 5.0, DOS 3.3, and an IBM PC-XT. My program hooks interrupt 09h (keyboard interrupt) and checks for a hot-key (Ctrl-^) to pop up. If the key is detected, a message appears on the screen. My problem is writing the message. I tried to use DOS interrupt 21h, function 09h, but it hangs every time. I got the program to work using BIOS calls, however. I can get interrupt 21h calls to work in the initialization part of my program, but once I'm inside my interrupt handler, it goes off into outer space when it tries to return.

Jim Ratti

The basic problem lies not in your code but in the fact that MS-DOS was designed to be a single-tasking, single-user operating system. The majority of the MS-DOS kernel is not "reentrant." That's to say, it cannot be called by an interrupt handler if it was already executing at the time the interrupt occurred.

For example, imagine that an application has called MS-DOS to perform a file function, the file operation is in progress, an interrupt occurs, and a program that is invoked by the interrupt also calls DOS to request a file function. Instant disaster! DOS's stacks and internal variables get bashed, the context of the original file operation function call is lost, and a crash is almost certain to follow.

There are a variety of ways to get around these reentrancy problems, most of which involve use of semidocumented or undocumented MS-DOS function calls and internal flags. Most or all of the necessary techniques have been presented in the body of the source code for the various "pop-up utilities" that have appeared in PC Magazine's Productivity section over the last year. Programmer's Journal ran some nice articles on TSR programming in

1987, the ms.dos/secrets conference on BIX is a gold mine of TSR information, and the new MS-DOS Encyclopedia (Microsoft Press, 1987) contains a detailed chapter on writing TSRs, complete with a working example. Finally, you might find one or both of the following books to be helpful: Turbo C Memory Resident Utilities, Screen I/O, and Programming Techniques, by Al Stevens (MIS Press, Portland, Ore., 1987, ISBN 0-943518-35-0); Performance Programming Under MS-DOS, by Michael J. Young (Sybex Books, San Francisco, Calif., 1987, ISBN 0-89588-420-8). Both books contain extensive information on writing TSRs.

CORNUCOPIA OF QUERIES

Joel A. Charbonnet, Jr., submitted a lengthy list of worthy questions. I've arranged them and provided a reply to each individually, below.

Q. To which audience is your column directed, a novice or an experienced C and assembler programmer?

A. I guess I'm still working this out to some

> ■ Programmers are drooling over the 80386, which has segments as large as 4 gigabytes, and six segment registers, to boot.

extent, but my mental image of the typical Power Programming reader is either (1) a programmer with some Pascal or BASIC experience who wishes to learn C, (2) a C programmer who wants to learn something about assembly language, or (3) an assembly language programmer who needs additional tools for his work and wants to pick up some information about higher-level, structured languages at the same time. This is why I have tried to present C and MASM programming topics in parallel: the C programmer can use his C

experience as a stepping stone to understanding the MASM routines, the MASM programmer can do the same in the other direction, and the BASIC or Pascal programmer can pick his poison!

In "Building on a Sound Structure" (Power Programming, December 8, 1987) you stated, " . . . the maximum amount of memory that it [a program] can address simultaneously is 256K." Is this because one has only four segment registers to use and each one can access only 64K?

A. That's right. Incidentally, this gives you some idea why programmers are drooling over the 80386, which has segments as large as 4 gigabytes, and six segment registers, to boot.

Q. In the same issue, you wrote, "A minimum of three segments must be declared in an .EXE program: a code segment, a data segment, and a stack segment." Does each one have to be a unique segment? If this is true, then a minimum of 192K is needed to run even the smallest of .EXE programs. Am I understanding this correctly?

A. Here we are getting into some confusion between the "logical," named segments as they exist in source code for a program, and the physical segments that exist at runtime. Each physical segment need not occupy 64K—it can be as small as a byte—but each is addressed independently by placing its base paragraph address in a segment register.

Q. What exactly do "Groups" do for us? What happens if you don't specify "DGROUP"? Are there any other special Group names?

A. The declaration of a "Group" allows several different logical segments to be addressed from the same physical segment base address. In other words, you can use different segment names in order to force the linker to group certain code or data together, thus suiting the structural requirements of your program, and then declare the segments as a Group so that the code or data in each can be accessed without the need to change the contents of a segment register. Of course, all the logical segments in a Group must fit within a physical 64K segment or the linker will issue an

■ POWER PROGRAMMING

error message and your program will not execute properly.

DGROUP *is a name used by the Microsoft compilers (and linker) to designate the segment that holds the "near data" (accessed through segment register DS) and the program's stack and local heap. If you are programming purely in MASM for MS-DOS, you can ignore it; however, if you wish to mix MASM and C routines, proper use of* DGROUP *is essential.* DGROUP *also has specific significance under OS/2 and Windows, where it receives special treatment from the system loader, which brings programs into memory for execution. I'll discuss this subject in more detail in future columns.*

Q. What do the "Combine Type" and "Class" names do for us? Can they be ignored?

A. The optional "Combine Type" in a segment declaration controls the way the linker lumps together segments with the same name that are found in different object modules. For example, logical segments with the same name and the "public" attribute are concatenated together in the same physical segment, while segments with the "common" attribute are overlapped so that they all have the same base address.

In addition to the control you can exert with segment names and the order of segment declaration, "Class" names allow another level of control over segment ordering by the linker. For example, once the linker has collected all logical segments with the same name together according to their combine type, it then arranges differently named segments with the same class name so that they are adjacent in memory. Chapter 5 of the MASM 5.0 Programmer's Guide contains a very nice discussion of segment naming, segment attributes, groups, and classes.

Q. What is "ASSUME" used for?

A. The ASSUME directive notifies the assembler which segment registers you are using to address which named segments. This allows the assembler to generate segment overrides automatically when they are needed, and to warn you when you reference a label or variable that can't be reached with any of the current segment

register contents. Note that ASSUME does not generate any code! You have to load the segment register with the correct value with separate, explicit instruction statements, as, for example:

```
mov     ax,DATA
mov     ds,ax
assume ds:DATA
```

Q. In "Parsing Routines in C and Assembler" (Power Programming, December 22, 1987), I believe there is a typo in the code on page 367. What appears as

```
argv8:      mov     ax,3000h
            int     21h
```

should be

```
            mov     ah,30h
            int     21h
```

Is this correct?

A. My code is (in this case, at least) correct. The instruction

```
            mov     ax,3000h
```

places 30h in AH and 00 in AL. This covers the case for MS-DOS, Versions 1.x, where

> ■ **DGROUP has specific significance under OS/2 and Windows, where it receives special treatment from the system loader.**

function 30h is not a defined function supported by the operating system. When MS-DOS 1.0 and 1.1 are called with an illegal function number, they simply return to the calling program with all registers unchanged. Initializing register AL to zero before making the function 30h call ensures that your program won't be misled under MS-DOS 1.x by some spurious value that just happened to be in register AL prior to the call.

Q. In "Examining the MS-DOS Environment" (Power Programming, January 12,

1988), you wrote "When one program (the parent) uses the MS-DOS EXEC function to launch another program (the child), it must provide, as one of the parameters, a pointer to an environment block." Does the parent just randomly choose a place for an environment block?

A. The parent program can build a new environment block anywhere it wants and can pass the pointer to it, so long as the new environment is paragraph-aligned (i.e., its address is evenly divisible by 16). Most of the time, though, the parent simply passes a zero pointer for the environment, so that the child inherits a copy of the parent's environment.

Q. Does the parent randomly put information into this environment block or is it empty?

A. If the parent program builds a new environment block to pass to the child program, it should take care that the new environment looks like the one that would be provided by COMMAND.COM if the child program was run directly by typing its name at the MS-DOS prompt. In most cases, if the parent wants to pass information through the environment, it should simply append this information to a copy of its own environment and pass a pointer to the modified copy. The parent should never pass an "empty" environment to a child, because this would make it impossible (or very difficult) for the child to load and execute a secondary copy of COMMAND.COM (since it would be missing the PATH and COMSPEC environment variables).

Q. Is the parent passing a pointer to a pre-existing environment block? If so, why can't the child update it, since the child has a pointer to that environment block?

A. In every case, MS-DOS copies the block supplied by the parent, or the parent's own environment, to a newly allocated block of memory and supplies the child program with a pointer to the new block. Thus, the child program never has direct access to the parent's environment.

Q. Who determines where to place the environment block for the child program?

A. MS-DOS, in its infinite wisdom, decides where to place the environment for

■ POWER PROGRAMMING

the child program. (Almost always it's immediately before the child's program segment prefix, at the base of the memory block holding the program's code, data, and stack.)

Q. Is the code for this environment passing and building in the parent process, the EXEC function, or MS-DOS?

A. The code for environment building and passing is in the EXEC function (interrupt 21h function 4Bh), which is logically a

> ■ **The parent simply passes a zero pointer for the environment, so that the child inherits a copy of the parent's environment.**

part of the MS-DOS kernel. In some IBM versions of MS-DOS, however, the main part of the EXEC code is physically located in the resident portion of COMMAND.COM, which complicates things immensely for people who are trying to write a replacement MS-DOS "shell" or command processor.

PC MAGAZINE'S IRS

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Opher Banarie

You can download all of the source code for this column from PC Magazine's dial-up bulletin board, the PC Magazine Interactive Reader Service, at (212) 696-0630 or (415) 598-9100. Use 300, 1,200, or 2,400 bps, 8 bits, no parity, 1 stop bit. I will also investigate making the code available on other information services such as CompuServe and will provide further details in future columns.

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■ DOUGLAS COBB AND STEVEN COBB

SPREADSHEET CLINIC

*Safeguarding macros from display and accidental deletion; canceling {onerror} statements;
measuring print range width; showing the way back when you shell out to DOS.*

CANCELING {ONERROR}

Canceling an {onerror} condition does not
need to be as complex a procedure as that
described by Anders Forsell in the September 29, 1987, Spreadsheet Clinic.
Forsell described the method he uses to
cancel an {onerror} statement when the error that is intended to be trapped does not
occur. In such a case he routes the macro to
a statement such as {onerror OK}. This
statement cancels the previous {onerror}
statement and instructs *1-2-3* to route the
macro to the cell named OK if an error occurs. OK contains a command that does
not affect the execution of the macro.
Next, he routes the macro to a statement
that deliberately causes an error. This error
trips the new {onerror} statement, which
branches the macro to the innocuous command in OK and cancels error trapping.

There's a far simpler way. In your macro, just include an {onerror} statement that
does not have any arguments. When *1-2-3*
executes this command, it cancels any {onerror} condition that may be in force at the
time and does not impose another.

Here's another little-known property of
the {onerror} command: If an error trips an
{onerror} command during the execution
of a subroutine, *1-2-3* forgets that it is in a
subroutine. Thus, instead of returning to
the main macro where it reaches the end of
the subroutine, *1-2-3* ends the execution of
the macro.

Loren Krienke
San Diego, California

Mr. Krienke is correct on both counts.
While we're on the subject of the {onerror}

command, we'd like to point out a useful
but seldom-used feature of the {onerror}
command: its ability to record the error
messages. If you include the name or address of a cell as the second argument of
an {onerror} command, and an error trips
that command, *1-2-3* will record the message that would have been displayed at the
bottom of the screen in the cell specified by
that argument.

For example, the statement {onerror
RESUME, ERRMSG} commands 1-2-3 to
record the message for the error that trips
it in the cell named ERRMSG. If you trip
that statement by typing the name of a file
that doesn't exist after issuing the /File Retrieve command, *1-2-3* will enter the label
'''File does not exist'' into ERRMSG.

1-2-3's ability to record these error
messages makes it possible to create "conditional" {onerror} commands. The macro shown in Figure 1 demonstrates this
technique. This macro is designed to print
the range you specify. Two principal
things could go wrong during the execution of this macro: the user could specify
an invalid range, or there could be a prob-

lem with the printer. The {onerror} routine
in this macro catches both errors and reroutes the macro differently for each one.

The first statement in this macro commands 1-2-3 to route the execution of the
macro to the cell named TEST in the event
of an error and to record the message for
that error in the cell named ERRMSG. The
second statement issues the /Print Printer
Range command and allows you to specify
the range you want to print.

In most cases, *1-2-3* will continue by
printing the range you specified, then end
the macro. If an error occurs, however,
1-2-3 will enter the message for that error
into the cell named ERRMSG and route the
execution of the macro to the cell named
TEST. If you specified an invalid range,
ERRMSG will contain the label ''Invalid
cell or range address.'' In that case, the
first {if} statement in TEST will be true and
1-2-3 will return to the beginning of the
macro. If you specified a valid range but
there was a problem with your printer,
ERRMSG will contain the label '''Printer
error.'' In that case, the second {if} statement will be true, and 1-2-3 will tell you to

```
\p        {onerror TEST,ERRMSG}
          /ppr(?)~q
PRINTIT   /ppagpq

TEST      {if ERRMSG="Invalid cell or range address"}{Branch \p}
          {if ERRMSG="Printer error"}{Getlabel "Check printer, then press
          {Enter}...",NULL}{Branch PRINTIT}
ERRMSG
NULL
```

Figure 1: *You can create conditional error-trapping routines by recording the message for the
error that tripped the {onerror} command and comparing it with the message for the error you
expected. Note that the second {if ERRMSG=} line is a single line, not two lines as shown.*

■ SPREADSHEET CLINIC

check the printer and then press Enter. When you do so, 1-2-3 will route the macro back to the cell named PRINTIT (the third statement in the macro). The statement in that cell contains the cell commands 1-2-3 to print the range you specified.

MEASURING A RANGE, REVISITED

In the Spreadsheet Clinic of May 12, 1987, William J. Sheppard described a ruler he uses to measure the width of a spreadsheet range. His instructions call for the user to type the characters 123456789! repeatedly, to create a ruler that is at least as long as the range to be measured.

I've found a way to avoid the tedium of typing all of these characters manually. First, set the width of the current column to whatever width (up to 240 characters) you want your ruler to be. Next, enter the label \123456789! into that cell. Since this label begins with *1-2-3*'s repeating label prefix (the backslash), *1-2-3* will automatically display the repeating sequence

`123456789¦123456789¦...`

all the way across the cell's width. The cell will contain only the ten characters 123456789!, however.

Once you have entered this label, you should print it to a file. To do this, use the /Print File command; specify the name of the file in which you want to print what is displayed in that cell; set the left margin to 0; specify a right margin greater than the width of the cell you are printing; choose the Unformatted option to suppress the spacing for top margins, bottom margins, headers, and footers; return to the main Print menu; and choose Go. Works will then print the ruler into a one-line text file, exactly as it appears in the cell.

Once you have saved the ruler in a .PRN file, you can import it into any worksheet that contains a range you want to measure. Just insert a blank row above the range you want to measure, move the cell pointer to the cell of that row that is in the leftmost column of the range, issue the /File Import Text command, and choose the name of the file to which you printed the ruler. The ruler will then appear in the worksheet. You can then use the ruler to measure the width of the range.

— Laura Klein
Chicago, Illinois

Figure 2: This macro measures the width of a range.

The technique described by Ms. Klein works in any release of 1-2-3. In fact, it's the best we've seen for creating a ruler (or any long, repeating label) in 1-2-3, Release 1A.

However, for users of 1-2-3, Release 2 and 2.01 (as well as all releases of Symphony), there's a still easier way to create a ruler. Instead of widening a cell and using the repeating label prefix, you can use 1-2-3's @REPEAT function. Specifically, you'd use the function

`@REPEAT("123456789¦",x)`

where x is the number of times you want 1-2-3 to repeat the string. For example, you would use the function

`@REPEAT("123456789¦",24)`

to create a 240-character ruler. The string result of this function will overlap any blank cells to its right, so you can use it to measure the width of any range.

Since this function is relatively simple, it's not difficult to enter it manually into any worksheet that contains a range you want to measure. If you wish, however, you can use the /File Xtract command to save it in a .WK1 file, then use the /File Combine command to combine it into any worksheet that contains a range you want to measure. If you want to save the result of the function (the ruler) instead of the function itself, you should use the /Range Values command to replace the @REPEAT function with its result before you use the /File Xtract command.

Rather than use a ruler to measure the width of a range, however, we prefer to use the simple macro shown in Figure 2. The first statement in the macro lets you highlight the range you want to measure.

(You need to select only one cell in each column of the range.) The second statement moves the cell to the first column of that range. The third statement enters the value 0 into the cell named WIDTH. The fourth statement sets up a {for} loop that 1-2-3 executes as many times as there are columns in the range. During each pass through the loop, 1-2-3 adds the width of the current column to the value in WIDTH and moves the cell pointer to the next column. After 1-2-3 has measured all of the columns in the range, it moves the cell pointer to the WIDTH, which at that point will contain the width of the range.

RETURNING FROM DOS

In the November 10, 1987, Spreadsheet Clinic, you presented a technique for keeping the message "(Type Exit and press [RETURN] to return to 1-2-3)" on the screen at all times after you have shelled out to DOS from within 1-2-3 using the /System command. I'd like to offer an improvement, shown in Figure 3.

Instead of placing the message on the same line as the traditional DOS prompt, this batch file puts them on separate lines. The first line contains the message; the second line contains the regular DOS prompt. The characters $_ cause this split.

— Michael D. Kran
Castro Valley, California


```
echo off
prompt (Type Exit and press [RETURN]
     to return to 1-2-3)$_$p$g
cd \
lotus
123
cd \
prompt $p$g
```

Figure 3: This batch file divides the DOS prompt onto two lines.

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■ SPREADSHEET CLINIC

Mr. Kran's suggestion is indeed an improvement. Mr. Jok Kamhi of Istanbul, Turkey, suggested still another enhancement, which is shown in Figure 4. This batch file uses ANSI escape sequences to reposition the cursor and write to the screen. Specifically, it writes the "(Type Exit and press [RETURN] to return to 1-2-3)ee!" message on the top line of the

```
echo off
prompt $e;s$e1;1f$e;1m(Type Exit and
to return
        to 1-2-3)$e;9m$e;u$1$p$g
cd \lotus
123
cd \
prompt $p$g
```

Figure 4: This batch file instructs DOS to write the message "(Type Exit and press [RETURN] to return to 1-2-3)" at the top of the screen whenever it presents a prompt.

screen whenever the DOS prompt is displayed. This is exactly where the message that 1-2-3 generates originally appears when you first access DOS. Mr. Kamhi has made the message bold to differentiate it from the other text on the screen.

To use Mr. Kamhi's technique you must have the statement

device=ansi.sys

in your CONFIG.SYS file, and that file must be in the root directory of the disk from which you boot your computer.

SECURING YOUR MACROS

I've discovered a good way to protect the macros in my 1-2-3 worksheets. First, I place all my macros at the upper-left corner of the worksheet—columns A and B and as many rows as it takes to accommodate all of the macros. Then, I use the /Worksheet Titles Horizontal command to freeze the macro-containing rows off the top of the worksheet. Finally, I use the /Worksheet Column Hide command to hide columns A and B. These actions hide the macros from view and protect them from the effects of inserting and deleting rows and columns.

To illustrate, suppose the macros in your worksheet occupy cells A1..B50. To protect them you would scroll the worksheet so that rows 51 through 70 were visible on the screen. After doing this, you would position the cell pointer in cell A52,

then issue the /Worksheet Titles Horizontal command. This command freezes rows 1 through 50 (the rows that contain the macros) off the top of the screen and freezes row 51 (the first row below the macros) onto the screen. (Unfortunately, there's no way to freeze rows off the top of the screen without freezing at least one row onto the screen.) After freezing, you would use the /Worksheet Column Hide command to hide rows A and B.

Peter J. Laszcz
Washington, D.C.

Mr. Laszcz's method of protecting macros works as advertised, but it prevents your using a portion of the worksheet (specifically, the cells in columns C through IV in each of the frozen rows). Since all 1-2-3 worksheets have more rows than you can possibly use, and 1-2-3's Release 2 and 2.01 use a sparse-matrix method of allocating memory, these unused rows won't limit the potential size of your Release 2 or 2.01 worksheets to any significant extent.

> ■ To protect the macros
> in my 1-2-3 worksheets,
> I freeze the macro-
> containing rows off the
> top and hide the columns.

On the other hand, 1-2-3, Release 1A, allocates memory to every cell in the active area. Consequently, Mr. Laszcz's method of protecting macros can reduce the usable capacity of your Release 1A worksheets considerably.

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■ PAUL SOMERSON

USER-TO-USER

Preventing software installation programs from modifying AUTOEXEC.BAT and CONFIG.SYS files; and making programs think you have less memory when they won't run.

LESS IS MORE

I recently ran across a program that would not run properly on a system in which more than 512K was installed. Although this sounds strange, I've run across other commercial and public-domain programs that have this problem.

One possible cause is the program's use of a signed compare and jump where an unsigned compare and jump in checking memory size is appropriate. You can address up to 512K with 19 address bits and need a 20th bit to go any higher. A signed comparison will interpret this as a negative value and report insufficient memory.

To fix this, I wrote the MEM512.COM program created by the MEM512.ASM assembly language code in Figure 1 or the BASIC MEM512.BAS program in Figure 2. It looks at the memory size variable set by the diagnostic code during boot-up. If this variable says your system has more than 512K installed, the program sets it to indicate that only 512K is available. It then performs a special reboot (INT 19) that bypasses system diagnostics to avoid the memory-sizing routine. The system will load normally except that it will think it has only 512K RAM.

If you run MEM512.COM on a system with 512K or less, it will display a message indicating the amount of RAM and then quit without rebooting.

The equate MEMSIZE is currently assigned the value 512. If you want to reduce the amount of memory even further, change the number here.

Barry Herbert
Garland, Texas

```
TITLE 'MEM512 - limit memory size to 512K
;
; This program will limit the amount of RAM known to the operating system
; to 512K bytes.
;
; If more than 512K is installed in the system, the memory size variable
; is set to 512(K) and the system is rebooted without ROM diagnostics
; or memory re-sizing.
;
; If the amount of RAM installed is less than or equal to 512K bytes,
; a message is displayed informing the user of the amount of RAM in the
; system. No further action is taken.
;
MEMSIZE  EQU     512                     ;Limit of memory size (in K)
;
; Macro to print a string of text and by '$'
;
PRINT   MACRO   STRING
        MOV     DX,OFFSET STRING
        MOV     AH,9
        INT     21h
        ENDM
;
; Macro to delay so user can read message on screen
;
DELAY   MACRO
        LOCAL   DELAY_1,DELAY_2
        MOV     AL,5
DELAY_1: MOV    CX,0FFFFh
DELAY_2: LOOP   DELAY_2
        DEC     AL
        JNZ     DELAY_1
        ENDM
;
; Code segment starts here
;
CSEG    SEGMENT
        ORG     100h
        ASSUME  CS:CSEG,DS:CSEG
;
INIT:   PRINT   STRTMSG                  ;Display the "start" message
        MOV     SX,40h                   ;DS:SX <= ptr to mem size variable
        MOV     DS,SX
        MOV     SX,13h
        MOV     AX,WORD PTR [SX]         ;AX <= memory size value
        CMP     AX,MEMSIZE
        JBE     MEM_OK                   ;Jump if memory size LE 512K
```

(continued)

Figure 1: *MEM512.ASM assembly language code to create MEM512.COM program, which will trick DOS into thinking you have only 512K RAM. You may substitute other RAM amounts by changing the number following MEMSIZE EQU and fixing the other text references.*

■ USER-TO-USER

```
;--------------------------------------------------------------
; Memory size is greater than 512K - set the memory size variable to 512(K)
; and reboot the system without re-sizing memory
;
        MOV     WORD PTR [BX],MEMSIZE    ;Set memory size to 512K
        PUSH    CS
        POP     DS                      ;Restore DS to "CSEG"
        PRINT   RESTMSG                 ;Tell user we're rebooting
        DELAY
        INT     19H                     ;Read bootstrap from disk; pass control
;--------------------------------------------------------------
; Memory size is less then or equal to 512K - tell user the current amount
; of memory and take no further action.
;
MEM_OK: PUSH    CS
        POP     DS                      ;Restore DS to "CSEG"
;
; Move ASCII value of mem size to output string. Mem size is in AX.
;
        DIV     BYTE 10
        OR      AH,30H
        MOV     KBYTES[2],AH
        AAM
        OR      AX,3030H
        XCHG    AL,AL
        MOV     WORD PTR KBYTES,AX
        PRINT   SIZEMSG                 ;Display the message
;
        INT     20H                     ;Exit to dos
;--------------------------------------------------------------
RESTMSG DB      'Rebooting to set memory size to 512K',13,10,'$'
SIZEMSG DB      'System memory size is currently '
KBYTES  DB      3 dup ('0'),'K',13,10,'$'
STRTMSG DB      10,13,'Mem-512 tricks dos into thinking '
        DB      'system has 512K or less of Ram',13,10,'$'

BYTE_10 DB      10                      ;Used by Divide instruction in MEM_OK

CSEG    ENDS
        END INIT
```
(Figure 1 ends)

DISAPPEARING ACT

I've read comments from several readers complaining about how software installation programs that alter existing AUTOEXEC.BAT or CONFIG.SYS files. One way to avoid these unwanted modifications is to change the attributes of the two files to Hidden. DOS will still access both files without complaint during boot-up, but it will not allow any programs to modify or delete them.

Brad Stephenson
Jenison, Michigan

Changing the file attributes to "hidden" or "read-only" will prevent programs from overwriting them. The SCRIPT file shown in Figure 3 will create four files called HIDE.COM, UNHIDE.COM, RO .COM, and UNRO .COM. Type this
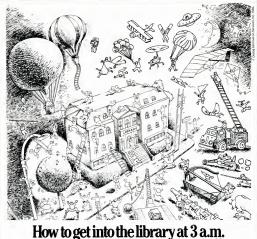
■ Some software had problems with more than 512K, but these days, many programs need 600K just to say hello.

SCRIPT file using a pure-ASCII word processor. Be sure to leave the blank line above RCX and to press the Enter key at the end of each line, especially the last one. Then make sure DEBUG.COM, Version 2.0 or later, is handy and type

```
DEBUG < SCRIPT
```

```
100 ' MEM512.BAS program to create MEM512.COM -- Barry Herbert
110 IF B=4:CLS:PRINT "Checking DATA; please wait..."
120 FOR B=1 TO 15:FOR C=1 TO 16:READ A$:T=T+VAL("&H"+A$):NEXT
130 READ B$:IF B$<>T THEN PRINT "ERROR IN LINE"B*10+180:END
140 T=0:NEXT:RESTORE:OPEN "MEM512.COM" AS #1 LEN=1
150 FIELD #1,1 AS D$:FOR B=1 TO 15:FOR C=1 TO 16:READ A$
160 LSET D$=CHR$(VAL("&H"+A$)):PUT #1:IF B=15 AND C=6 THEN 180
170 NEXT:NEXT:T$=$:NEXT
180 CLOSE:PRINT "MEM512.COM CREATED"
190 DATA BA,9E,01,B4,09,CD,21,BB,4B,00,8B,5B,00,88,B3,00,8B,1729
200 DATA 07,3D,00,02,76,1A,C7,07,00,02,6B,1F,BA,58,01,B4,914
210 DATA 89,CD,21,B8,05,B9,FF,FF,82,FE,FE,C8,75,F7,CD,19,2651
220 DATA 06,1F,F6,36,E3,01,80,CC,30,88,26,99,01,D4,0A,0D,1516
230 DATA 38,38,86,88,A3,97,01,BA,77,01,B4,09,CD,21,CD,20,1739
240 DATA 52,65,62,6F,6F,74,69,6E,67,20,74,6F,20,73,65,74,1560
250 DATA 20,6D,65,6D,6F,72,79,20,73,69,7A,65,20,74,6F,20,1463
260 DATA 35,31,32,4B,0D,0A,24,53,79,73,74,65,6D,20,6D,65,1173
270 DATA 6D,6F,72,79,20,73,69,7A,65,20,69,73,20,63,75,72,1544
280 DATA 72,65,6E,74,6C,79,20,30,30,30,4B,0D,0A,24,0A,0D,1493
290 DATA 4D,45,4D,2D,35,31,32,20,74,72,69,63,6B,73,20,64,1208
300 DATA 6F,73,20,69,6E,74,6F,20,74,68,69,6E,6B,69,6E,67,1627
310 DATA 20,73,79,73,74,65,6D,20,68,61,73,20,35,31,32,4B,1316
320 DATA 20,6F,72,20,6C,65,73,73,20,6F,66,20,52,61,6D,2C,1275
330 DATA 0D,0A,24,0A,00,00,00,00,00,00,00,00,00,00,00,00,69
```

Figure 2: BASIC MEM512.BAS program to create MEM512.COM program, which will trick DOS into thinking you have only 512K RAM.

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To hide CONFIG.SYS, just type

    HIDE CONFIG.SYS

To unhide it later, type

    UNHIDE CONFIG.SYS

To make AUTOEXEC.BAT read-only, type the command

    RO AUTOEXEC.BAT

and to bring it back to normal, type

    UNRO AUTOEXEC.BAT

These four files use function 43h of INT 21 to first check the existing attribute byte and

```
N HIDE.COM
A
MOV BX,80
INC BX
CMP BYTE PTR [BX],20
JZ 103
MOV DX,BX
INC BX
CMP BYTE PTR [BX],D
JZ 116
CMP BYTE PTR [BX],0
JNS 10B
MOV BYTE PTR [BX],0
MOV AL,0
MOV AH,43
INT 21
OR  CX,2
MOV AL,1
MOV AH,43
INT 21
INT 20

RCX
2B
W
E 120 E1 FD
N UNHIDE.COM
W
E 120 C9 01
N RO.COM
W
E 120 E1 FE
N UNRO.COM
W
Q
```

Figure 3: *SCRIPT file to create HIDE.COM, UNHIDE.COM, RO.COM, and UNRO.COM. Type it in using a pure-ASCII word processor. Make sure you leave a blank line above RCX and that you press Enter at the end of every line, especially the last one.*

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CREDIT CARDS ACCEPTED

■ USER-TO-USER

change only the bits that need modification. ORing the existing value with 1 makes it read-only; ORing it with 2 makes the file hidden. ANDing it with FE takes away the read-only attribute; ANDing it with FD unhides the file. Other attributes (system or archive) remain as they were.

Unfortunately, you can't use function 43 to change the attribute byte of subdirectories or volume labels, so this won't let you meddle with those.

Be careful when hiding files en masse. If you issued a command such as

    FOR %A in (*.*) DO HIDE %A

you'd end up with a whole directory of hidden files. You won't be able to use a similar command to unhide them, since DOS won't see any files to unhide. You'll have to unhide all your files individually, since wildcards don't work with hidden files. The safest thing to do if you hide lots of files is first to create a master file listing all

> ■ Making all your root directory files hidden may look interesting, but it can confuse other people.

the filenames, and then to put this master file in some other directory or on some other disk. If you're on drive C: you could use a command like

    DIR > B:C-HIDDEN.LST

Making all your root directory files hidden may look interesting, but it can confuse other people who try to work with your system. Making them read-only will prevent other programs from changing (or delet-

ing) them, but you'll still see them in normal DIR searches.

Some awful installation programs change things as they proceed. They may rename a driver file on the original disk or delete files once they've copied them to a hard disk. If the installation process is interrupted, or if it's so dumb that it doesn't know when something's gone wrong, you may have trouble reinstalling things later.

A safer way is simply to create a \ROOTBACK subdirectory one level down from the root and copy all your important root directory files into it. When something changes the files in the root directory, or if you somehow erase them, you can log into the root directory and type

    COPY ROOTBACK

If you do try this, make sure that if you ever change your AUTOEXEC.BAT or CONFIG.SYS files, you copy the new versions into \ROOTBACK.

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ANOTHER APPROACH

Another clever way to prevent having software packages replace or otherwise modify AUTOEXEC.BAT files was submitted by William H. Dixon:

The AUTOEXEC.BAT file on my disk contains just one real line (after an initial ECHO OFF):

```
ECHO OFF
SETPATH STARTUP
```

All it does is execute another batch file called SETPATH.BAT:

```
SET NORMPATH=C:\DOS;C:\UTIL;C:\
PATH %NORMPATH%
%1
```

SETPATH.BAT sets the path, then executes the STARTUP.BAT file, since its %1 replaceable parameter refers to the word STARTUP in the last line of the AUTOEXEC.BAT file.

The STARTUP.BAT file contains all the commands I normally would have placed in an AUTOEXEC.BAT file:

```
PROMPT $P$G
PRINT /D:PRN /Q:32
CARDFILE C:\UTIL\CARDFILE.TXT
DOSKEY
CTYPE /NA
SPEEDUP
```

There are several advantages to this technique:

(1) The AUTOEXEC.BAT file is easy to re-create if it is destroyed or inadvertently modified.

(2) The PATH command is in its own separate batch file, making it easy to change if directories are added or removed.

(3) The SETPATH.BAT file makes it easy to restore the default path if it has been changed.

(4) By creating a batch file like ADD-PATH.BAT,

```
PATH %NORMPATH%;%1
```

it's easy to add a new directory to the path temporarily, and then restore it later with SETPATH.BAT.

(5) If all memory-resident programs are removed by utilities such as MARK/RELEASE or INSTALL/REMOVE, running STARTUP.BAT restores those programs as they were at power-on time.

William H. Dixon
Leesburg, Florida

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■ EDITED BY CRAIG L. STARK

POWER USER

Coloring columns in dBASE; more ROUNDing errors; automatic uppercasing and simultaneous document editing in WordPerfect; printing multiple copies in Word.

ROUND() FUNCTION, SQUARE HOLE

Brian Danenberg's letter (Power User, August 1987) correctly identifies an anomaly in *dBASE III's* ROUND() function. Negative numbers are actually rounded to the next *smaller* integer, so that

ROUND(−5.5,0)=−5

whereas

ROUND(5.5,0)=6

This means that offsetting entries will not equate if the ROUND() function is used, but at least the result is predictable.

Clipper (Autumn '86) is in fact even worse than *dBASE III* in its implementation of the ROUND() function. Indeed, as documented in the table "A Comparison of ROUND() Function Results," if you're using ROUND() with *Clipper*, you'd better rewrite your code.

Robert O. Banziger
Batavia, Ohio

Among dBASE III, Clipper (Autumn '86), and FoxBASE Plus, only FoxBASE implements the ROUND() function correctly (in my opinion, anyway). As Mr. Banziger's table shows, Clipper's results are so bad you shouldn't even be using the ROUND() function. Of the 2,000 ".5" numbers between −1000.5 and 999.5, only 28 return correct results with this program. The same anomalies occur using Clipper's STR() function for rounding.

Nantucket is aware of the problem, and has corrected it in the new Summer '87 release (the upgrade for which is free—how nice!). In the new version, all numbers

round so that positives and negatives will offset. If you must continue using Autumn '86 for some reason, the Winter '87 Nantucket News suggests a workaround:

rounded=(INT(x*10+.5))/10

Unfortunately, this formula produces the same imperfect results as does

A Comparison of ROUND() Function Results

	Correct	dBASE	Clipper
ROUN(-9.5,0)	-10	-9	-9
ROUN(-8.5,0)	-9	-8	-8
ROUN(-7.5,0)	-8	-7	-8
ROUN(-6.5,0)	-7	-6	-6
ROUN(-5.5,0)	-6	-5	-6
ROUN(-4.5,0)	-5	-4	-4
ROUN(-3.5,0)	-4	-3	-4
ROUN(-2.5,0)	-3	-2	-3
ROUN(-1.5,0)	-2	-1	-1
ROUN(-0.5,0)	-1	0	-1
ROUN(+0.5,0)	1	1	0
ROUN(+1.5,0)	2	2	1
ROUN(+2.5,0)	3	3	3
ROUN(+3.5,0)	4	4	3
ROUN(+4.5,0)	5	5	4
ROUN(+5.5,0)	6	6	6
ROUN(+6.5,0)	7	7	6
ROUN(+7.5,0)	8	8	8
ROUN(+8.5,0)	9	9	8
ROUN(+9.5,0)	10	10	9

dBASE—all positive numbers round up while the negative numbers also round up (because of the "+.5").

In *Clipper's* defense, the problem originates inside the Lattice C, with which *Clipper* is compiled. Lattice acknowledges that the errors arise inside the Lattice library when manipulating floating-point bits ("It's a tricky problem—other areas are involved") and is working on it.

In the meantime, to get correct results, you need to employ Danenberg's technique of using the ABS() function.

Incidentally, I've had a number of letters defending dBASE's philosophy from a mathematical point of view. I still prefer the Lotus approach, however, because I want the dollars and cents of offsetting entries to offset.—Brad Stark

COLOR PRINTING FROM DBASE

Even without using *dBASE* programming you can send color instructions to your printer using simple Escape sequences. I wanted different columns of my report printed in different colors, so with my Epson FX-100 and including a .DBF with fields called Name, City, and Country, I entered

red=CHR(27)+CHR(1)
green=CHR(27)+CHR(2)
black=CHR(27)+CHR(3)

Then I typed

LIST red+name,green+city,;
black+country TO PRINT

[We have broken the above LIST command into two lines to fit the magazine's mar-

■ POWER USER

gins. When you enter it yourself, remove the semicolon and combine the two lines into one.—Ed.] If you wish to highlight only certain records, you could use the IIF() function or actually add the Escape sequences to the fields of these records. If you wanted all records from New York highlighted, you could enter

```
REPLACE ALL City WITH red+City+black;
FOR State="NY"
```

[Again, remove the semicolon to make the above a single line.—Ed.] Bear in mind that the Escape sequences consume space in the field, so the field must be long enough to avoid truncation.

Hassan El Meligy
Cairo, Egypt

Even if you don't have a color printer, you can use Mr. El Meligy's techniques to boldface or underline. See your printer manual for the appropriate Escape sequences. Just make sure you always turn off any enhancements you turn on, and remember that printing will be correspondingly slower.

Mr. El Meligy is correct that a dBASE character field can hold Escape sequences. This can be useful in emphasizing special records. The drawbacks: the field will no longer SORT or INDEX normally; there is a great danger of truncating the field; and you must remember to remove the Escape sequences later.

You can also implant Escape sequences in REPORT FORMS and LABEL FORMS.

—Brad Stark

CAPSTART

I have a habit of not pressing the Shift key hard enough after a period, so I end up with a lowercase letter at the beginning of

the next sentence. Rather than cure the habit, I found it easier to write the macro in Figure 1. It simply capitalizes the first character of every word immediately following a period.

Yvonne Tallini
Weedsport, New York

I modified Ms. Tallini's original macro to take advantage of WordPerfect's conditional chaining. It's easy enough to transfer control from one macro to another—you just invoke the other during your macro definition. But if the first macro contains a search, you can arrange it so that the second macro executes only when the search is successful. All you need to do is make the second macro the last command in the first. In this case, the command is Alt-C itself, so the macro will execute again and again until it doesn't find any more periods.—Neil J. Rubenking

BOTHDOCS

I often want to edit two documents at once, and so I've written the BOTHDOCS macro shown in Figure 2. I displays the current directory and lets you select a file from it, then does the same for a second document. It uses the Ctrl-PgUp macro key to allow user input: just move the highlight around with the arrow keys and hit Enter to select one. You'll need WordPerfect 4.2 to use this macro, however, as previous versions don't have the Ctrl-PgUp feature.

There are two Down commands in the macro definition. Their purpose is simply to ensure that when you're defining the macro you don't try to retrieve a subdirectory. If you're in the root directory when you define the macro, you don't need those two lines at all.

`<Ctrl-F10>`	Begin macro definition
`<Alt-C>`	Call it Alt-C
`<F2>.<F2>`	Search for a period
`<Ctrl-Right>`	Jump to the start of the next word
`<Alt-F4>`	Block on
`<Right>`	Mark the first character
`<Shift-F3>`	Switch it to uppercase
`<Alt-F4>`	Block off
`<Alt-C>`	Call this macro again
`<Ctrl-F10>`	End macro definition

Figure 1: A WordPerfect macro that automatically uppercases the first letter in a sentence.

■ POWER USER

```
<Ctrl-F10>              Begin macro definition
BOTHDOCS                Name it BOTHDOCS
<F5><CR>                List files
<Down>                  Be sure you're not retrieving a subdirectory
<Ctrl-PgUp><CR><CR>     Take user input
1                       Retrieve the file
<shift-F3>              Switch documents
<F5><CR>                List files
<Down>                  Be sure you're not retrieving a subdirectory
<Ctrl-PgUp><CR><CR>     Take user input
1                       Retrieve the file
<Ctrl-F10>              End macro definition
```

Figure 2: This WordPerfect 4.2 macro permits you to edit two documents simultaneously.

If you want to edit two documents as soon as you start running WP, just use the command

```
WP /M=BOTHDOCS
```

This executes the BOTHDOCS macro as soon as the program starts.
—Neil J. Rubenking

MULTIPAGE PRINTING WITH WORD

When Microsoft Word prints multiple copies of a page, each copy gets reformatted every time from scratch. With HP LaserJet this is unnecessary, since the printer can produce multiple copies far faster than Word can. The HP Escape sequence for this is

```
Esc&lNX
```

where N is a number from 1 to 99. In Word, you can enter the Escape character by holding down the Alt key and typing 27 on the numeric keypad. You can place the command anywhere on a page. For example, the sequence

```
Esc&l25X
```

would print 25 copies of the page in which it appeared.

For real elegance, however, put this code in its own paragraph, format the paragraph with a line spacing of zero, then place it in the glossary with the name MULTI. That way you can simply pop it into any document as needed, without disturbing the page formatting.
Richard W. Cobb
Stormville, New York

There's actually an even more sophisticated solution. Rather than enter the command in the glossary as text, enter it as a macro. Then use the pause command to have the macro stop for you to enter the number of pages to print. In Word's syntax, the macro is

```
<Esc>&l\pause·X<esc>fpdown ?2-8<enter>
```

Enter the first Escape by holding down the Alt key, typing 27, and releasing the Alt key. It will show up on-screen as a small arrow pointing to the left. Enter the second Escape as usual—hitting the Esc key if creating the macro in learn mode, or typing <Esc> if creating it as text. The chevrons [also called guillemets or European quotes—Ed.] surrounding "pause" are typed by holding down the Alt key and typing [for the left chevron] and] to produce the right chevron.

By substituting the appropriate commands you can use this trick on any laser printer with multipage capability. You'll be impressed by the difference in speed. Alas, you will have to collate the output manually, since the printer will print all copies of each page before moving on to the next. On my Canon LBP-8II, using Metro Software's LaserTwin to emulate the HP, entering the command on page 1 maintained multipage printing throughout the document.—M. David Stone

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■ EDITED BY ROBERT L. HUMMEL

LANGUAGES

Named constants in Turbo Pascal to make INLINE code easier to read and write; bitmaps to decrease a C program's memory requirements; and a BASIC program that performs a warm boot.

BASIC

WARM BOOTING FROM BASIC

In PC Tutor, June 23, 1987, there was a discussion of how to force a PC to perform a warm boot. However, in my case, I needed to be able to do this from within a BASIC program. By disassembling WARMBOOT.COM, I was able to isolate the steps required to accomplish this.

The BASICA program listing (Figure 1) will cause a warm boot when added to a program and then run. A cold boot is even easier to do, although it will cause a longer delay due to the PC's memory check. To convert this routine to perform a cold boot, remove lines 30 through 130, change the ARRAY(7) in line 20 to ARRAY(2), and then change the FOR counter in line 200 to FOR I = 0 TO 4.

Dr. Thomas G. Burnakis
Southgate, Michigan

To convert this routine for use with Quick-BASIC or Turbo Basic you will have to use CALL ABSOLUTE, which is equivalent to BASICA's CALL command. CALL ABSOLUTE is built into Turbo Basic directly; however, you must first use

```
DEF SEG = VARSEG(ARRAY(0))
```

before the POKE and CALL statements, to make the array's segment the current default.

In QuickBASIC 2.0, ABSOLUTE is an external routine contained in the file

USERLIB.OBJ, *though in later versions it is in its own file named ABSOLUTE.OBJ. Regardless of which version of QuickBASIC you're using, this object module must be linked to your program after it has been compiled.*—Ethan Winer

C

COMPRESSING WITH BITMAPS

When the elements of an array are going to be used as flags to indicate yes/no or on/off status, the individual bits of each byte can be used to reduce memory overhead.

On IBM PC-class machines, a byte is 8 bits, which means a character array can track eight times as many elements (or be eight times smaller, depending on your needs). Each element of a list can be represented by a single bit, with every 8 bits stored in a single array element. When an element is to be set (named ON), the position of the character containing the bit is found and the bit set to 1. Resetting the bit (turning it OFF) requires the bit to be set back to 0.

BITTEST.C is a small program that demonstrates the use of these bit manipulation routines.

S. Manipoopathy
Bangalore, India

Bitmaps and bit manipulations are not new. But C makes bit manipulation so easy that it's a sin not to take advantage of it, as Mr. Manipoopathy's program, shown in Figure 2, so aptly demonstrates. I can think of a lot of times when bitmaps would

```
10 ' Machine language warm reboot procedure
20 DEFINT A-Z: P=0: I=0: J=0: DIM ARRAY(7)
30 DATA &HB8              :REM This is the hex code
40 DATA &H40              :REM for the warm reboot.
50 DATA &HB8              :REM It first goes to the
60 DATA &H8E              :REM memory address 0040
70 DATA &HD8              :REM and places 1234 (hex)
80 DATA &HC7              :REM into memory.  Then it
90 DATA &H06              :REM branches to FFFF:0000,
100 DATA &H72             :REM the address where the
110 DATA &H00             :REM CPU begins to execute
120 DATA &H34             :REM instructions after a
130 DATA &H12             :REM power on.  From here
140 DATA &HEA             :REM the PC's BIOS jumps
150 DATA &H00             :REM to the start of its
160 DATA &H00             :REM diagnostic routines.
170 DATA &HFF
180 DATA &HFF
190 REM
200 P=VARPTR(ARRAY(0)): FOR I=0 TO 15: READ J: POKE(P+I), J: NEXT
210 SUBRT=VARPTR(ARRAY(0)): CALL SUBRT
```

Figure 1: *Running this subroutine in a BASIC program will force the PC to do a warm boot.*

■ LANGUAGES

```
/* bittest.c
 * tests bit-map routine
 */
#include<stdio.h>
#include<mem.h>
#include"PcMag.h"          /* standard definitions    */

#define BITMAP_SIZE 1024
#define NUM_BITS    8
#define MAXVAL      (BITMAP_SIZE*NUM_BITS)
#define Bmap_init(bitmap,size)   memset(bitmap,0,size)

unsigned char bitmap[BITMAP_SIZE];      /* can track 8000 elements */

main()
{
    int m,i;
    char    linebuffer[100];

    Bmap_init(bitmap,BITMAP_SIZE);      /* initialize the bitmap to 0  */

    while(TRUE)
    {
        printf("\nEnter a number to put in the list & <RETURN> ("S to go
on):\n");
        if(!gets(linebuffer))
            break;
        i = stoi(linebuffer);
        if(i < 0 || i > MAXVAL)
            printf("\nOnly numbers from 0 to %d are valid in this demo",MAXVAL);
        else
            setbit(bitmap,i);
    }

    while(TRUE)
    {
        printf("\nEnter a number to EXCLUDE from the list & <RETURN> ("S to go
on):\n");
        if(!gets(linebuffer))
            break;
        i = stoi(linebuffer);
        if(i < 0 || i > MAXVAL)
            printf("\nOnly numbers from 0 to %d are valid in this demo",MAXVAL);
        else
            resetbit(bitmap,i);
    }

    printf("\nThe included numbers are:\n");

    for(i = 0, n = 0; i < MAXVAL; i++)
        if(isbitset(bitmap,i))
        {
            n++;
            printf("%3d %c",i, ((n % 13) ? ' ' : '\n') );
        }
    printf("\nThat's it");
}

    /* setbit() - turns ON bit n in bitmap      */
setbit(bitmap,n)
char    *bitmap;
int     n;
{
    bitmap[n/8] |= (1 << (n % 8));
}

    /* unsetbit(bitmap,n) - turns OFF bit n in bitmap  */
resetbit(bitmap,n)
char    *bitmap;
int     n;
{
    bitmap[n/8] &= (~(1 << (n % 8)));
}

    /* isbitset() - returns TRUE if bit n is ON on bitmap, else returns FALSE */
isbitset(bitmap,n)
char    *bitmap;
int     n;
{
    return (bitmap[n/8] & (1 << (n%8)));
}

    /* End of bittest.c ************************/
```

Figure 2: *BITTEST.C demonstrates the use of bitmaps and bit manipulation routines to reduce memory overhead.*

have gone a long way in improving the memory requirements of one of my programs: tracking previously asked questions in a trivia game program or a list of record numbers from a database selection, for example. In fact, a small model program (limited to 65,535 bytes of data space) can easily track over 250,000 elements of a list using a 32K bitmap.

Whenever you use bitmaps, make sure that the maximum number of elements being tracked does not exceed a value eight times the number of bytes in the bitmap; otherwise, you're sure to get "unpredictable results"—a program crash. I did this, and the "bug" disappeared once I realized my error and increased the size of the bitmap.

BITTEST.C uses a 1K bitmap to track over 8,000 elements. You can adjust this if you wish, but remember that data space in a small model program is limited, and most compilers require the "Huge" inventory model to be used to create an array larger than 64K. You can also declare a "Huge" pointer and allocate over 64K from the far heap.

The bitmap initialization routine (a macro call to memset) should always be called before commencing calls to bitmap routines. This insures that the bitmap is properly initialized to all zeros.

FLIPPING BITS The setbit() function turns on a specific bit in the bitmap. To do this, it first calculates which byte in the bitmap contains the bit to be set, by dividing the bit number by 8 (the divide operator ignores any remainder). For example, bit number 7 (starting with 0) would be in byte 0, and bit number 24 would be found in byte 3—the quotients of (7 / 8) and (24 / 8), respectively.

Next, setbit() finds the individual bit in the selected byte via the C modulus operator, which returns the remainder of a division operation. Calculating the remainder of 7 divided by 8 (7 % 8 in a C modulus) returns 7, or the seventh bit of byte 0; bit number 24 would be the zeroth bit of byte 3 (24 % 8). Fortunately, setbit() performs this automatically for us.

Finally, setbit() must turn that particular bit ON. It does this by taking the value of 1 (or 00000001 in binary) and shifting it left by the bit number. Bit 7, for instance,

Turning On Specific Bits

Byte number	0	1	2	3
Bit number	76543210	76543210	76543210	76543210
Before	00000000	00000000	00000000	00000000
After setbit(bitmap,7)	10000000	00000000	00000000	00000000
After setbit(bitmap,24)	00000000	00000000	00000000	00000001

7 (bit 7 for 0)   (bit 0 of byte 3) 24

The first 32 bits of a bitmap before and after bits 7 and 24 have been set.

results in 10000000 (1 shifted left seven times). Note that the bits are referred to here on a right-to-left basis, so that bit 7 is the seventh bit from the right side of each byte (beginning with 0).

This creates a mask that is used to turn on the appropriate bit via the bitwise OR operation. An OR operation always returns TRUE or FALSE depending on two operands is TRUE. So, ORing a bit set to 1 (10000000) with a bit set to 0 (00000000) will always result in a 1 (10000000).

The table "Turning On Specific Bits" shows the first 32 bits of a bitmap before and after bits 7 and 24 have been set.

To reset a bit in the bitmap (i.e., to turn it OFF), the same steps are taken in reset-bit) with the exception of the OR operation. Instead, a logical AND is used (which returns FALSE unless both operands are TRUE). To insure that the appropriate bit is turned OFF without affecting the other bits in a byte, a mask must be created that contains a 0 in the appropriate bit. In other words, to turn off bit 7, we must create a mask the opposite of 10000000—that is, one that looks like this: 01111111.

ANDing a byte with this mask will turn bit 7 OFF without affecting the remaining bits. Other bits that are ON will stay ON, while bits that are OFF will remain OFF. That's the nature of the AND operation and this particular mask.

To create this second mask, the complement of the first mask is used. Designated by the tilde (˜), the complement operator reverses all of the values of the bits in a byte. So while ORing a bit with a 1 will

force it ON, ANDing the bit with the complement of 1 (or 0) will force it OFF.

The remaining function, isbitset), returns TRUE or FALSE depending on whether the appropriate bit is ON or OFF. It accomplishes this by ANDing the bit with the original mask and returning the result of the AND operation. This will only return TRUE if the bit has been set.

To test these functions, BITTEST.C prompts you for a series of numbers to include in the list, which are added to the list via setbit). Then it prompts for numbers to be excluded from the list and resets them via resetbit). Finally, it uses isbitset) to print the list of included numbers on the screen.

Bit manipulation routines can also be written as macros, too, depending on how much "in-line" code you want scattered all over your program. Either way, the functions in BITTEST.C can reduce your list tracking data overhead considerably.
—Richard Hale Shaw

```
CONST
  ES_Override   = $2690;  {ES Override of instruction}
  LES_DI_BPdisp = $BEC4;  {load addr on stack into ES:DI}
  MOV_AX_BPdisp = $868B;  {move integer on stack to AX}
  ADD_DI_AX     = $0501;  {add AX to [DI]}
  SUB_DI_AX     = $0529;  {subtract AX from [DI]}
  INC_DI        = $05FF;  {increment [DI]}
  DEC_DI        = $0DFF;  {decrement [DI]}

PROCEDURE ptr_incr(VAR Pntr);
  (* increment a pointer *)
BEGIN
  INLINE(LES_DI_BPdisp/Pntr);  {load addr of variable in ES:DI}
                                                    (continues)
```

Figure 3: Demonstrating the use of named constants for INLINE opcodes.

■ **LANGUAGES**

```
   INLINE(ES_Override/INC__DI); {increment variable ES:[DI]}
END;

PROCEDURE ptr_add(VAR Pntr; bytes : Integer);
{* add a number of bytes to a pointer *}
BEGIN
   INLINE(LES_DI_BPdisp/Pntr);     {load addr of variable in ES:DI}
   INLINE(MOV_AX_BPdisp/bytes);    {mov length to AX}
   INLINE(ES_Override/ADD__DI_AX); {add AX to ES:[DI]}
END;

PROCEDURE ptr_decr(VAR Pntr);
{* decrement a pointer *}
BEGIN
   INLINE(LES_DI_BPdisp/Pntr);     {load addr of variable in ES:DI}
   INLINE(ES_Override/DEC__DI);    {increment variable ES:[DI]}
END;

PROCEDURE ptr_sub(VAR Pntr; bytes : Integer);
{* subtract a number of bytes from a pointer *}
BEGIN
   INLINE(LES_DI_BPdisp/Pntr);     {load addr of variable in ES:DI}
   INLINE(MOV_AX_BPdisp/bytes);    {mov length to AX}
   INLINE(ES_Override/SUB__DI_AX); {subtract AX from ES:[DI]}
END;
```

(Figure 3 ends)

Turbo Pascal and use DEBUG. In DE-BUG I assemble the instructions I need and note the actual bytes that represent them. Either way makes writing INLINE tedious. Mr. Selesky's method makes so much sense, it's a wonder we haven't seen it before. Just create an $Include file of constants for common opcodes and then refer to them by name in your INLINE code. Remember, untyped constants don't take up any code space. They're strictly for your benefit.—Neil J. Rubenking

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■ ROBERT L. HUMMEL

PC TUTOR

Understanding the sparsely documented SHELL statement and its relation to the three basic DOS files can let you select the command processor that runs your system.

THE SHELL STATEMENT

The SHELL statement is probably the most neglected, misunderstood, and poorly documented command available under PC-DOS. Throw in version variations and add to this the confusion created by similarly named commands in many languages, and you have a recipe for obscurity. To help demystify SHELL and help you optimize the performance of your system, I'll go over the syntax, defaults, undocumented options, and alternatives in this column. To properly understand SHELL, however, it's well to begin with a brief review of the different programs that make up DOS and that handle the system loading, or boot, procedure.

As sold by IBM, DOS consists of a pair of floppy disks that contain approximately 50 separate files. Most of these files are utilities, which IBM calls external commands. Only three files are crucial to system operation: IBMBIO.COM, IBMDOS.COM, and COMMAND.COM. (In MS-DOS systems these files are named IO.SYS, MSDOS.SYS, and COMMAND.COM, respectively.) These three files, known collectively as the system files, are located on what IBM called the "Main" disk, also known as a system, boot, bootable, or DOS disk.

The curious among you have probably just returned from taking a directory of a system disk. You'll have noticed that, while COMMAND.COM appears in the listing, the other two files do not appear. Because of limitations in the boot procedure, these two files must always be the first two (albeit invisible) entries in the di-

rectory. (I'll save the discussion of why this is so until someone asks.) To protect these files from being moved or corrupted, they have been given special properties, or attributes, that prevent normal file functions from affecting them. Specifically, IBMBIO.COM and IBMDOS.COM are marked with the Hidden, System, and Read-only attributes, which, as a side effect, prevents them from being listed by the DIR command.

The Hidden attribute makes the file invisible to most file operations, including DIR, COPY, DEL, and ERASE commands. The System attribute has about the same effect as Hidden. A file that has the attribute Read-only is "protected": any attempt to erase or copy over the file results in the error message, "Access Denied." Scary, huh? Of course, there are many utilities that will let you get at and manipulate these files and even change their attributes. Charles Petzold's ATTR.

COM (Programming/Utilities, PC Magazine, June 10, 1986) is an excellent tool for checking and changing file attributes.

While its exact contents vary in details among different versions of DOS, IBMBIO.COM (IO.SYS) generally contains the low-level hardware interface that is specific to the PC. The routines that handle the keyboard, printer, display, clock, and boot device are contained in this file and have the responsibility of insulating the remainder of the operating system (OS) from the hardware.

The DOS application program interface (API), or kernel, as it is frequently called today, is contained in the file IBMDOS.COM (MSDOS.SYS). Presented to the programmer as a hardware-independent interface, this file contains the system-level routines normally associated with DOS. All the familiar file, disk, and video INT 21h functions are processed by this module.

When your PC is booted and the two system files, IBMBIO and IBMDOS, have been successfully loaded, the operating system is, in essence, complete. It has all the necessary routines in place to service an executing application. The only thing it does not have is a user interface. This is a specialized program that allows the user to enter commands and access system resources. Known as the command processor, or shell, it is simply a user interface to the operating system, not the operating system itself. The familiar, default command processor for DOS is COMMAND.COM.

To perform any useful work, the OS

■ **To perform any useful work, the OS shell must be capable of processing user commands and loading other application programs.**

■ PC TUTOR

shell must be capable of processing user commands and loading other application programs. COMMAND has the ability to process a number of internal commands, such as DIR and CLS. It can also load and execute other programs or be run as a program itself.

The routine that processes the CON-FIG.SYS file allows you to specify the top-level command processor that DOS will use. By including in your CONFIG.SYS file the statement

    SHELL=[d:][path]filename[.ext]

you can cause any executable program to be loaded as the top-level shell. (Chances are, you've seen the SHELL statement with some other options, but these are really arguments to COMMAND, and not part of the SHELL syntax.) Before you start reconfiguring your system disks, however, note that COMMAND.COM is a lot smarter than it lets on. Even renamed, it still knows that it's called COMMAND, and will insist on finding itself under that name. Attempts to cajole DOS versions prior to 3.2 to load COMMAND.COM from other than the boot device will also fail, as COMMAND checks for the reload-able copy on the boot device.

But should you desire, you can, for example, specify DEBUG.COM as your shell.

If you choose to experiment with alternate shells, be careful. Because a bad CONFIG.SYS file can keep your computer from finishing a boot, always keep a bootable diskette handy. Bear in mind also that most programs aren't written to be shells, and if you exit them, you'll find yourself with a hung computer.

USING COMMAND.COM I noted previously that the SHELL statement takes only one argument: the name of the program to load, along with an optional drive specifier and path. But when COMMAND is used as the shell, it offers several other options, depending on the DOS version used. Figure 1 below shows the full syntax

when you're using COMMAND as the shell. The /C, /P, and /D options have been available under all versions of DOS since 2.0. The /F and /E options were introduced in Version 3.1.

The first argument to SHELL is a file specification that indicates where the initial copy of COMMAND.COM can be found. Note that this can be any valid path on any valid device that exists and contains a copy of COMMAND.COM at the time the SHELL statement is executed. It is possible, for example, to create a device driver that would make a ROM appear as a read-only disk drive and specify that device as the source for COMMAND.COM. As long as the DEVICE is initialized before the SHELL statement is executed, and COMMAND.COM can be found on the device, everything will be fine. The initial device may also be a network drive if DOS can recognize the network as active before the SHELL statement is processed.

The second drive and path is an optional argument to COMMAND that specifies where it should look when it needs to reload itself. The need to reload has nothing to do with the operation of the SHELL statement. COMMAND was designed to split itself into a resident and a transient portion in order to leave more memory free for execution of applications. Large programs may overwrite the transient portion, located in high memory, causing COMMAND to attempt to reload that portion when it regains control. If COMMAND.COM cannot be found, the message "Insert disk with COMMAND.COM in drive x:" will appear, where x: is the drive specified in the second argument. If this argument is not specified, then it defaults to the location of the original COMMAND. Again, the only restrictions are that the device must exist and that a copy of COMMAND.COM must be on it when the SHELL statement is processed. Unfortunately, this precludes specifying a RAM-disk.

The drive and path from this argument are fed into the environment in the form of

```
SHELL=[d:][path]COMMAND[.COM] [d:][path] [/C|/P[/D]] [/E:n][/F]
```

Figure 1: *The full syntax for the SHELL statement, when the default shell COMMAND is used, is shown above. Explanations and restrictions of the arguments are given in the text.*

■ PC TUTOR

the COMSPEC parameter, which COMMAND uses to find itself, and which many other programs use to find the shell. To examine the COMSPEC variable after booting, enter SET, with no arguments, at the command line. If you cannot set this variable, it will always be in the SHELL statement, you can always set it in your AUTOEXEC.BAT.

The switches accepted by COMMAND .COM vary according to the DOS version, so we'll discuss the common ones first. The /C (Command) switch is documented. It tells the newly loaded COMMAND to perform the internal command named or to load and execute the program that follows on the line. When the command or program is finished, COMMAND itself will terminate and return control to the calling program.

With a little thought, you can see why this is the one option that should not be used in the SHELL statement. That part of DOS that processes the CONFIG.SYS file loads COMMAND and passes control to it. But because you used /C, COMMAND will automatically terminate and return control. The problem is, DOS doesn't want it and doesn't know what to do with it. The result is an immediate need for a cold boot.

The /P (permanent) switch tells COMMAND that it should make itself permanent. The effect of this is to set some internal flags that make this first version of COMMAND behave somewhat differently. First, a flag is set that tells this copy to ignore the EXIT command (that would hang the machine). It also sets a flag that tells COMMAND to find, load, and process the AUTOEXEC.BAT file. If, some time during your normal DOS session, you execute a second COMMAND you then execute a normal COMMAND and reload AUTOEXEC. Needless to say, this will waste memory, will gain you nothing, and should be avoided.

The /D (Don't execute AUTOEXEC) switch, when used in combination with the /P switch, disables the automatic execution of the AUTOEXEC.BAT file.

The /F (Fail) switch first appeared in Version 3.1 and appears to be a poorly written patch to the original 3.0 code. When specified, it causes the critical error handling code in COMMAND to automat-

ically fail any error. The "Abort, Retry, Ignore" message is still displayed, along with the system's reply, but the user is not required to enter anything.

This option might initially seem useless, but I can think of a few situations where it would come in handy. If you are operating your PC from a remote system, or automatically, via batch file, and you accidently cause a critical error, this option will allow the PC to continue to function without the need for an operator at the keyboard.

The /E (Environment) switch arrived in Version 3.1, as well. Like the /F switch, it appears to be a hasty patch to the 3.0 code. It is undocumented and unsupported, but it does work consistently. For Version 3.1 only, the syntax is /E:n where nn stands for the number of 16-byte paragraphs of memory to be allocated for the size of the environment. The valid range is from 10 to 62 paragraphs, inclusive. The default is 10 paragraphs, or 160 bytes. This switch is valid for only the first COMMAND that is processed. Subsequent loads will ignore it.
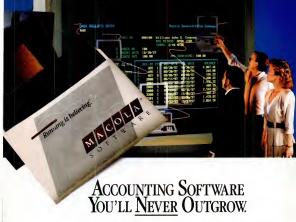
In Versions 3.2 and later, the /E switch routine was rewritten and the syntax was changed. The argument is now specified in bytes and has a valid range of 160 to 32768 (32K). The default environment size is, again, 160 bytes. Unlike previous versions, the /E switch is now also allowed with secondary processors.

EVERYTHING IS NEW AGAIN
Now that all the secrets of the SHELL statement have been revealed, two thoughts should spring to mind. The first is that if you're still using an older version of DOS you're past due for an upgrade. The second is, why hasn't anyone written a replacement shell for DOS?

ASK THE PC TUTOR
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■ **FRANK J. DERFLER, JR.**

CONNECTIVITY CLINIC

Increasing the transfer rate between the network and server; a program to move data from the IBM System/36 to Lotus 1-2-3 on a PC; choosing a DOS version for your LAN.

CODENOLL FIBER LAN SPEED
In your recent review of fiber LANs ("Making Connections: The Who, Why, and How of Fiber-optic LANs," *PC Magazine*, January 12, 1988), you report that Codenoll's Codenet fiber LAN had a slower transfer rate between the network and the server than a network using 3Com's cards and coaxial cable. If, as you state, the Codenoll cards are electronically the same as the 3Com cards, what causes the difference and is it enough to worry about?

Bob Dreher
Denver, Colorado

The difference between the transfer times reported for the Codenoll and 3Com systems comes from the use of the 3Com EtherLink Plus card in the network server, not from the network media. The EtherLink Plus card has its own on-board processor and message buffers. It does a better job of moving data between the network and the server.

The cards we received from Codenoll were its version of the less-capable 3Com Model 3C501 cards. We used one of these Codenoll cards in the server, and the overall performance suffered. We could have added an outboard Codenoll fiber modem to an EtherLink Plus card and gotten faster performance with fiber advantages, but typically we don't mix and match products from different manufacturers except to test compatibility.

Our LAN benchmark tests load networks very heavily. I'm sure you wouldn't notice the difference between Ethernet coaxial and fiber performance in typical in-

stallations, but if you want equal performance, put a smarter card on the server.

SYSTEM/36 DATA TRANSFERS
In response to Vivek Chanmugan of Austin, Texas (December 22, 1987), there is an easy way to transfer data from the IBM System/36 to *Lotus 1-2-3* on a PC. If the program you are operating on the System/36 can print your data to the screen or to the System/36 print queue, the $225 *On-Demand* program, from Brainware Computer Products (tel.: (714) 969-1327), can help. This program runs on the PC and captures data from the System/36 terminal screen to a .PRN file, which can then be imported to *1-2-3* or just about any spreadsheet or database program. It is not necessary to purchase a file transfer program for the System/36.

I use the program on an IBM PC AT with an IBM 5250 Emulation Adapter to gather monthly accounting data for use in

■ **DOS 3.1 brings in the record- and file-locking calls that applications need to allow multiple, simultaneous access to the same data files.** ■

budgeting and financial analysis without the help of data processing personnel or programmers. Brainware has different versions of *OnDemand* that work with other 5250 terminal emulators, as well as 3270 versions.

Matt Claflin, C.P.A.
Medford, Oregon

DOS VERSIONS ON A LAN
We recently started installing hardware and software for a 3Com network. One of the problems I have come across is memory consumption on the workstations. 3Com networking software will not run under any version of DOS prior to 3.1. When I called Microsoft, asking for information on the different DOS versions, the company said I should buy a book. I need to assess the merits/penalties of using different DOS versions, and I need to tell users who are using DOS 2.1 what will change after I upgrade their machines. Can you help?

Peter Norloff
Fairfax, Virginia

Mr. Norloff, you have to move everybody over to DOS, Version 3.1 (or 3.3), for three good reasons, but none of these reasons will be highly visible to your users. Most important, DOS 3.1 brings in the record- and file-locking calls that applications need to allow multiple, simultaneous access to the same data files. If you want to share files, you need this capability in every workstation. Second, Version 3.1 includes network path recognition in the form of \\Server1\accounts\payables.

■ CONNECTIVITY CLINIC

This allows the use of application files, even on complex networks. Finally, it gives you the ability to address more than six drives.

Whatever version of DOS you select, we strongly recommend that you put the same version on every networked station. If users swap versions of COMMAND.COM, you invite those frustrating ''Incorrect DOS Version'' error messages.

MULTIUSER VERSUS LAN

The speed, power, and relatively low cost of 80386-based PCs make them excellent LAN servers or multiuser hosts. I would like to see *PC Magazine* compare LANs based on 80386 servers against PC-MOS or UNIX/Xenix-based 80386 multiuser systems. Let's see what the comparison shows on cost, system performance, and other criteria. I am particularly interested in the small-office environment with eight to ten stations.

Jim Trudeau
Chico, California

I agree with you that we should extend our evaluations to multiuser systems, but since I don't have the objective data to answer your question at this time, let me tell you what I think is pretty clear when comparing LANs against multiuser systems.

As far as costs goes, if you must go out and buy new PCs for every LAN workstation and if you're going to buy an 80386-based server anyway (your specification), the multiuser system is considerably less expensive than installing a new LAN. Tele-Video and Link Technologies are two of many companies making very nice-looking terminals with PC graphics and keyboards. The retail prices for these terminals are in the $500 range.

Looking at performance, when I asked people at Alcatel (which used to be ITT) and at Intel about the terminal-carrying capability of their 80386/Xenix-based systems, they stressed the importance of knowing the specific work done on the system. Applications that are disk-intensive, such as database sorting and compiling large programs, tie up a multiuser machine just as they do a LAN file server. They said that in ideal circumstances these systems can support up to 32 simultaneous users. I would say the same thing about a 386-based LAN server.

According to PC Labs director John Dickinson: ''In a multiuser system (goes the theory, and much of the practice), seldom do several users make heavy CPU or mainline I/O demands at the same time. If they happen to do that, the time-sharing monitor allows them minimal slices of time in which to share the scarce CPU and I/O resource fairly, giving the perception of equal performance.''

■ **CONNECTIVITY CLINIC**

There is also a corporate-culture issue to be addressed. People used to commanding their own PCs often resist multiuser solutions. LANs get around the fears of those who always want to be free to hit Ctrl-Alt-Del.

One other recommendation: if you want all of the benefits of PC operation, small desktop terminals, and many of the other benefits of multiuser computing, consider clustered-CPU systems. These systems put

■ **People used to commanding their own PCs resist multiuser solutions. LANs get around the fears of those who want to be free to hit Ctrl-Alt-Del.**

a special card, containing one or more CPUs plus RAM plus video, into a server—typically running Novell's NetWare. Each user has dedicated processing power and a small terminal. Companies such as Alloy, Advanced Digital, and InterContinental Microsystems make excellent clustered-CPU systems. The performances of these systems exceed those of 8-bit PC-based workstations on a traditional LAN under the same conditions.

NETWORK YOUR QUESTIONS
Connectivity Clinic gives you practical solutions to networking problems of all types. We'll pay $50 or more for any tips we print, plus an extra $25 if you submit your letter on a disk, and we'll gladly answer any questions you have, at no charge. We're sorry, but we're unable to answer letters personally.

Mail your contributions to Connectivity Clinic, PC Magazine, One Park Avenue, New York, NY 10016, or you may contact Frank J. Derfler, Jr., via MCI Mail (be sure to use Derfler's box named CONNECTIVITY CLINIC).

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*1987 Plan To Buy Study

PC MAGAZINE

HOW TO SUCCESSFULLY BUY THROUGH MAIL ORDER AND PROTECT YOUR RIGHTS

Mail order sales are governed by rules of the Federal Trade Commission (FTC) and various state laws. These guidelines are published as a service to you. Remember, the many vendors advertising in PC Magazine are eager to serve your needs.

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State precisely what merchandise you want, specifying details such as model, make, size, component parts, etc.;

Confirm the price and expected delivery date as stated in the ad;

Indicate whether you will accept a substitute product if the item you ordered is unavailable, and, if not, that your payment should be returned;

Don't send cash, you will have no record of payment if a problem arises, and;

Keep a copy of your order and all other correspondence with the Seller. Your records should include the company's name, address and phone number; a description of the item ordered; your cancelled check or a copy of the money order; record of the date you mailed the order; and any sales slips and shipping receipts.

When ordering by phone:

Note the time and date of your conversation and the name of the person you talk with;

Make a record of your order, the price, its promised availability and the components to be expected;

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Has there been an increase in the advertised price?

What warranties does the item carry? Who provides the service?

What is the Seller's return policy?

What is the Seller's refund policy?

With whom should you correspond if there is a problem?

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2. If you complain by telephone, send a follow-up letter to confirm what was said.

3. If you think the merchandise is defective, reread your product instructions and your warranty carefully to be sure you don't expect features or performance the product isn't designed to give. Then contact the Seller for instructions. Don't return it to the Seller until you have been instructed to do so.

4. When returning merchandise make sure you keep the shipper's receipt or packing slip; your right to be reimbursed for postal cost is determined by store policy.

5. If you have completely discussed your problem with the Seller and are still not satisfied, write to the consumer complaint agency in the Seller's state. If you paid for the merchandise by credit card, you may have rights to withhold payment under a Federal law called the Fair Credit Billing Act.

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PC MAGAZINE ■ APRIL 26, 1988
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USE THIS CARD TO OBTAIN FREE
INFORMATION ABOUT PRODUCTS
AND SERVICES IN THIS ISSUE (SEE OTHER SIDE)

COMING UP

PROJECT DATABASE FINALE Our three-issue database management blockbuster concludes with reviews of 43 programmable databases. To begin, Jim Seymour traces the historical model at IBM to the dominance of Ashton-Tate's dBASE III Plus, the most widely used database system. Seymour goes on to discuss the differences between packages that use Query by Example (QBE) and those that use Structured Query Language (SQL). Then our team of reviewers presses 38 programmable network, hierarchical, and relational databases to the limits of their abilities. Richard Hale Shaw's discussion of the relational model and SQL is followed by reviews of five programs that use this data manipulation language: Informix-SQL, Ingres for PCs, Professional Oracle, Unify RDBMS, and XDB-SQL. Our features tables and benchmark tests for all 43 products supplement the review team's appraisal of these programs.

A SPREADSHEET TAXONOMY In the last of his series, columnist Jim Seymour looks at Lotus's as-yet-unreleased 1-2-3, Release 3, and 1-2-3/G, and he offers tips to help you decide which new program is best for you.

UTILITIES Looking for a way to keep track of disk use? Now you can monitor file activity using our featured utility, RE-CORDER. It's great for wringing optimum performance from your RAMdisk.

AFTER HOURS In After Hours we examine some educational programs for children, ranging from the Stickybear series for toddlers to high-school-level astronomy and geography programs. And we take a special look at Tetris, an exciting new game that was written in the Soviet Union and is now being distributed by an American publisher. It's easy to learn but hard to stop playing: half of the magazine's staff is already hooked. We offer you some tips gleaned from their extensive hands-on experience, and we even have a commentary from John C. Dvorak on the Tetris craze.

AFTER HOURS

Peak Performance: Swim analyzes a single workout (as shown) or a series of workouts.

FITNESS

A Poolside Program to Keep Swimmers in Lane

BY EDWARD MENDELSON

Someday, when laptop computers become light and waterproof enough to be used as kickboards, someone will write a swimming program that you can use in the water. For now, you can use *Peak Performance: Swim* on a computer that sinks like a stone, because this program is designed for use on dry land after a workout in the swimming pool.

For $79.95, *Peak Performance* provides coaches and swimmers with a computerized logbook and database. The program records details of each day's workout, lets you know whether you are working near peak capacity, and estimates the number of calories that you burned.

The most useful tool for dedicated swimmers is the program's tough calculation of the intensity of today's workout, so that you can decide whether you should push harder tomorrow or simply take the day off. For each workout you receive a "workout intensity" estimate that is geared to past performance, along with an estimate

of the extent to which you used your full aerobic capacity.

Peak Performance: Swim doesn't offer specific suggestions or guidelines, but it can help you make better-informed decisions about your training. Two swimmers can use the copy-protected disks supplied. Everyone else in the swimming pool has to buy extra data disks at $10 each.

List Price: *Peak Performance: Swim*, $79.95. **Requires:** 128K RAM, one disk drive, DOS 2.0 or later. Copy protected. Peak Performance, P.O. Box 60681, Palo Alto, CA 94306; (415) 424-0208.

CIRCLE 675 ON READER SERVICE CARD

GAMES

Might and Magic: A Long Time Ago in a Land Far, Far Away . . .

By STEPHANIE K. LOSEE

New World Computing's *Might and Magic* might well be the most exciting castles-and-quests movie ever made, but with one difference: you're not watching the movie, you're actually in it.

You begin with a colorful map of the Land of Varn, replete with glaciers, mountains,

forests, and castles. You're allowed to take six characters (whose personalities you must first design) on a quest to discover the elusive "Secret of the Inner Sanctum." Each must make a contribution, so be sure to include a sorcerer and cleric to cast spells, along with the more battle-ready knight, archer, and paladin. And don't forget a robber—you'll want someone to pick locks and disarm traps along the way.

There are five towns in Varn whose Inns serve as a sort of "home base." Each time you check into an Inn, the experience, weapons, and trinkets your characters have gained along the way are saved, making it worthwhile to visit the nearest Inn frequently. When monsters destroy your party, you can continue the quest from the last Inn in which your characters stayed.

Your quest will take you through underground caverns, over mountains, and across deserts. These passages are constructed like a maze, and you must keep track of your wanderings by mapping your way using 16 by 16 grids. If you get lost, your sorcerer can cast a "Location spell" to save your party from certain doom.

Although mapping seems rather confusing at first, it very quickly becomes familiar and fun. If you tire of it, however, you can purchase *Might and*

Magic's Hint Book ($12.95), which includes not only maps of all 55 sectors of Varn but tips and answers to help you reach higher levels of play. (Newcomers to PC adventure games may be shocked at the idea of being asked to pay for help in using a $49.95 game, but it's a common practice.)

The program's user interface is so intuitive as to be kind, affording you time to adjust to the program and enjoy learning the basics before it assaults you with complexity. And the EGA graphics are low-resolution but use spectacular color; each new monster or set of scenery is more dazzling (or gruesome) than the previous one. A final rave goes to the manual and Hint Book: both are well written, well organized, and beautifully illustrated.

The program's tendency to crash when your party encounters an avalanche seems to be its only bug. But I can't complain too much—I got to reboot; my characters, however, were killed.

List Price: *Might and Magic*, $49.95. Hint Book, $12.95. **Requires:** 256K RAM with CGA, 512K RAM with EGA; two floppy disk drives or a hard disk; DOS 2.1 or later. Copy protected. New World Computing Inc., P.O. Box 2068, Van Nuys, CA 91404; (818) 785-0519.

CIRCLE 674 ON READER SERVICE CARD

On your quest you'll be asked by one of Might and Magic's resident monsters; the better your performance level, the more monsters you have to fight.

FITNESS

Getting to Know Your Diet: A Way to Count Calories and Fat

BY GUS VENDITTO

When you're trying to lose weight, it helps to have a gimmick. *Take Charge of Your Cholesterol* might have the right medicine for you. It wants to make you more conscious of your saturated fat intake, but it can keep tabs on calories, too, and it may make you miserable enough to get you pushing away from the table earlier.

The program is based on the book *Eater's Choice* by Dr. Ron Goor and Nancy Goor and gives you several screens' worth of lectures and dire warnings about heavy fat intake. (Dr. Goor researched the relationship between dietary fat and heart disease for the National Institutes of Health.) Their philosophy is that reducing saturated fat intake leads to lower cholesterol levels, and so the program aims to get saturated fats down to less than 10 percent of your daily fat. Many Americans take in as much as 30 percent of their calories as saturated fat.

And to make sure you read these for-your-own-good lectures, instructions for using the program are sprinkled through

Take Charge of Your Cholesterol can give you an ideal diet, or simply track what you're eating

that text and nowhere else in the package. But I've heard it before and found I was able to figure out the dos and don'ts of this program without wading through the sermon: it's all menu-driven and escape reversed. I did find that for a menu-driven program, it has one of the most cantankerous structures to be found anywhere.

Easily Forgiven

But this is a $34.95 health maintenance program, not a relational database manager, and minor annoyances are easily forgiven if the program delivers. And it does.

There are two ways to use *Take Control of Your Cholesterol*: plan a daily regimen that meets your low-fat goals, or track your daily consumption.

I preferred the latter and enjoyed keeping a running tally of the calories and fat in my foods. It determined a healthy caloric and saturated fat allowance for me (based on height, age, and body frame) and ran down the day's harm or benefit to the waistline war.

Tracking foods was tedious at first, but became a pleasant routine in time: You go through a long list of foods, mark off the ones you've eaten (or plan to), and then move to the daily schedule. When you're ready to insert items, the program reels them off and you add them at the right meal, selecting a portion of two, three or four times if needed. Calorie and fat accumulation are automatically debited to your account.

The success of this kind of system depends on the extent of the database, and *Take Charge* has most foods covered. Just about the only food I couldn't find was mayonnaise; other programs spend too much effort cataloging prepared foods and forget the basics.

If you pal yourself on a diet, you're invited to use any of the 200 recipes included, covering soups, entrees, vegetable dishes, and desserts. If you prepare a recipe, simply use its database number when you're tallying your daily consumption.

The recipes are really a bonus, but they're handy to have. They specialize in low-fat eating (margarine instead of butter,

egg whites instead of the whole egg) but the regimen is not too Spartan.

Of course, the only service a program like this can provide is to make you aware of your diet's impact on your body. And when you start to see those calories and fats add up, you're ready to start making the hard choices.

Use it, and you'll lose.

List Price: *Take Charge of Your Cholesterol*, $34.95 Requires: 256K RAM, one disk drive, DOS 2.0 or later. Not copy protected. Concept Development Associates, 45 Cordova St., St. Augustine, FL 32084; (904) 825-0220.
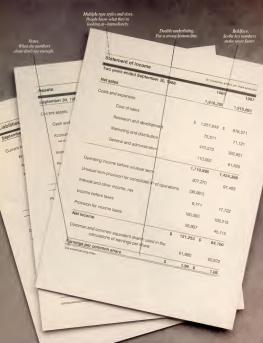
CIRCLE 876 ON READER SERVICE CARD

What They Don't Tell You at Wendy's

Ever wonder why fast food doesn't have calories and other nutritional information listed on the side of the box, the way foods like frozen vegetables do? Take a look at the actual numbers and you'll understand why the Colonel doesn't talk about saturated fat in his chicken.

Take Charge of Your Cholesterol includes USDA figures for some fast foods in its calorie/saturated fat counter database: they're enough to make you lose your appetite. A Big Mac has 563 calories, and 155 of them are saturated fat; a Kentucky Fried Chicken dinner is wing and a thigh) has 902 calories, with 107 saturated fat calories. In short: a man with a medium frame who ate a Big Mac, shake, and fries would consume more than his daily fat allowance in one meal.—*Gus Venditto*

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